The
GEOGRAPHICAL JOURNAL

Vol CXXIII Part 3 *September 1957*

THE PRESIDENTIAL ADDRESS, 1957

SIR JAMES MARSHALL-CORNWALL

TODAY WE STAND on the threshold of a new era in the advancement of geographical science. Last November Dr. Vivian Fuchs left this country in the *Magga Dan* with his gallant team, to attempt the crossing of the Antarctic continent. This is the last unexplored continent, that mysterious "*terra australis incognita*," which baffled for so long the earlier navigators. Already Dr. Fuchs has located mountain ranges 10,000 feet high, whose existence was not known a year ago. And, apart from this British Trans-Antarctic Expedition, the Antarctic continent is being subjected to a concentrated assault by the scientists of a dozen nations. A great deal of new knowledge is bound to accrue from all this effort and new fields will be opened up, so that the prospect for exploration and discovery is by no means exhausted; and research will follow in the wake of the explorers. It is axiomatic that this Society's *raison d'être* is not merely the exploration of fresh regions, but their exploitation by scientific research. To use a military metaphor, we must now consolidate the ground gained.

A year ago I referred to the need for the Society to maintain our objective by concentrating on research; the scope for our activity in this field is immense and not only in connection with newly discovered regions, for the already known territory still guards many secrets which must be probed. I will mention just a few of the projects which the Society has in mind in order to fulfil these tasks.

Within the last few months we have instituted a research studentship to determine what the actual coastline of Britain was nearly 2000 years ago, during the period of Roman occupation. A vast amount of evidence on this subject is available, but it has never before been comprehensively sifted and collated. In this project are associated with us such eminent archaeologists as Sir Mortimer Wheeler and Professor Ian Richmond of the British Academy. We have therefore opened up an entirely new field of geographical research, in which are correlated the activities and experience of the geomorphologist, the historian and the archaeologist.

Then we are planning to organize a centre for specialized geographical studies to be housed in our building, where we have unrivalled advantages for the research student in our Library and Map Room. A wide field for such research, both in the way of regional and systematic geography and historical geography, invites attention; though we must be careful not to duplicate, but to supplement the activities of other bodies, such as the university geography departments.

All these efforts, however, require financial support, and your Council has to use

its judgment in striking a just balance between the needs of exploratory expeditions and applied scientific research. Thanks to the Mount Everest Foundation, in the administration of which our Society and the Alpine Club share equally, expeditions to mountainous regions now receive liberal grants and encouragement. Expeditions which do *not* qualify for the Mount Everest grants have to be supported from the much smaller resources of the Society's exploration fund and of the Geographical Magazine Trust. During the past year the R.G.S. has distributed a little more than £1000 towards the cost of expeditions, mostly organized by universities, whereas the Mount Everest Foundation has given over £20,000.

But, as I have already indicated, research is becoming more important than ever, and we sadly lack the financial resources which we should be devoting to this purpose. There is a wide scope for useful activity in this field awaiting us, if only we could find the money to finance our efforts. I appeal to any of our Fellows, who have the means available, to endow a Research Fellowship which would enable the Society to fulfil its responsibilities in this direction.

While on the subject of research, I should here like to utter a warning to our physical geographers and geomorphologists to avoid the technical jargon with which they too often cloak their conceptions, when lecturing in this hall and contributing to our *Journal*. I might have hesitated to criticize professional geographers about the exercise of their craft, were I not emboldened to do so by the example of Sir Halford Mackinder, perhaps the greatest geography teacher that this country has ever produced. Forty-eight years ago Mackinder expressed his views before this Society as follows:

"If we are to induce writers on the humane aspects of geography to recognize real physical distinctions, we must seek to use such terms as will fit into literary English writing. It is no doubt easy, when you are talking to experts, to describe with precision by the use of technical jargon. It is a very hard thing to write a good plain English sentence. But if we adopt the easier method, and shirk the harder, then geographers are throwing away a great opportunity which lies before them. The opportunity is that of making precise the thought and the language of the practical man of affairs, whether he be politician, or writer, or merchant, or soldier." As an old soldier myself, I would beg the physical geographers to refrain from using technical terms, such as "non-accordant monadnocks," and stick to a form of English "understanded of the people."

During the past year we have maintained the high standard of our evening meetings and afternoon discussions. John Heaney's lecture on his Gough Island expedition was deservedly popular. Commander Foster described in lucid detail how the American scientific bases in Antarctica were established by the U.S. Navy. The Swiss climbers of Everest and Lhotse gave us a well illustrated story of their ascent. Colonel Wheeler gave us (in the Dickson Asia lecture) a revealing glimpse of Soviet activities in Central Asia, while expeditions to explore the Andean range were described by Major Tilman, Allan Cunningham, John Kempe, George Band and Michael Westmacott. Other geographical aspects of the South American continent were dealt with by Professor Steers and Dr. Dudley Stamp, while Mr. Farmer recently gave us an instructive review of pioneer settlement in south Asia.

Exhibitions open to the public have also been displayed in our galleries: an instructive one of Antarctic exploration; another to illustrate the development of cartography; one, which is still open, depicts the geography of Venezuela. Our Christmas lectures for children were again an outstanding success and deservedly popular.

I will leave our devoted Honorary Treasurer, Mr. Brooks, to deal with our financial position. In these difficult days of steadily rising costs, it becomes harder each year to balance our budget and to fulfil our manifold responsibilities. The only alternative to raising our subscription is to increase our membership, and this can only be done by the personal exertions of each of our Fellows. I am glad to report that our total membership has now reached the record figure of over 6700 (including 6530 Fellows, 185 Associate Members and 20 Corporate Members), but I should like to see it rise to 7000; that would only be an increase of 4 per cent.

The advantages of our Library and Map Room continue to be widely appreciated: the Library has an average of 76 borrowers a week, and the average number of books issued is 136 (this is nearly 14 per cent. above last year). During the past year, the Map Room has had 1500 visitors, 500 of whom were Fellows and the remainder research workers, students, and members of commercial organizations; 1800 telephone enquiries were received, mostly from commercial firms for place locations, and 1800 letters were answered by the Map Room, one-third of which were from Fellows. The services rendered by our staff in these and other departments, no less important, under our admirable Director and Secretary, Mr. Kirwan, have been maintained at a high level of efficiency.

It is a good moment, at the end of my third year of office, to look not only at the achievements of the past, but at the prospects and, more important, the needs for the future. I have already referred to the need to stimulate research, and I should perhaps say here that I consider research among our own archives a first duty to our forebears, for there is a great deal of most important material which is either unpublished or unworked upon. But, vital as the promotion of research is in the fulfilment of the first aim of our charter—the advancement of geographical science—we have another and, in many respects, more immediate requirement, and that is the needs of our Fellows and members, upon whose support our prosperity almost entirely depends.

I think it can be said that those Fellows and members in or within easy reach of London are in a favourable position and, judging by the size of our audiences in this hall, they take full advantage of the lectures, films and exhibitions arranged for their benefit. But others, living far from London and, even more, those living abroad, are inevitably at a considerable disadvantage. How best to offset this disadvantage within the means at our disposal is, I feel, not only one of the most pressing needs, but one of the most difficult problems which your Council have to face. Of the Fellows and members to whom I refer, a large proportion live more than 100 miles from London, and 1500 live permanently out of the United Kingdom. One solution, several times discussed by your Council, has been the possibility of a reduction in subscription. This solution, which would involve an unacceptable financial sacrifice, has also been rejected in the past because of the complicated accountancy it would entail, and because in the case of Home Fellows, a geographical limit, fair to all irrespective of means, would be exceedingly difficult to lay down. What then is the alternative? Are there any additional benefits which we could provide, and which we could afford to provide, to offset the amenities they lose? For these Home Fellows, we have often discussed the possibility of arranging lectures in the provinces. Indeed, on past occasions, this has been done. But, if the Society's name is to be linked with such meetings, some measure of control and coordination must be involved. This would increase the burden on our already overloaded permanent staff. Nevertheless, I consider that this possibility should be looked at again to see if, from time to time, provincial fixtures could not

be arranged in this way for the benefit of those for whom frequent visits to London are too expensive or too inconvenient.

An even more urgent problem, however, is that of Fellows living abroad, many of whom return on leave to this country only during the summer months and, therefore, outside our lecture session. The solution here, it seems to me, is to try to increase the publications available to them. They receive at the moment our quarterly *Journal*, the cost of which, despite every effort to economize space, now reaches the high figure of £5000 a year, due to the ever-rising costs of printing and paper. To increase the number of issues of the *Journal* would be financially out of the question. The *Journal* has rightly a predominantly academic content. This implies the acceptance only of papers, necessarily limited in number, which reach the high academic standards required. But our Fellowship, whether at home or abroad, by no means consists wholly of persons professionally concerned with the details of academic or technical research. Is there not, then, room for another publication, of a high intellectual standard, but more general and less specialized in content, which could be sent to Fellows abroad in addition to the *Geographical Journal*? Since I took office as your President, I have increasingly felt that the *Geographical Magazine*, which was founded a quarter of a century ago with the help of, and by agreement with, the Society, and which distributes the bulk of its profits in support of just those causes for which our Society was founded, should be linked more closely to us. Considerable progress has, as you know, been made in this direction in the last year, when the Trustees, the majority of whom are members of your Council, acquired a controlling financial interest. The *Magazine*, it is true, is available to Fellows and members at reduced rates. It is also offered to our young Associate Members as an alternative to the *Journal*. But I would like to go further and invite your Council to consider whether the *Geographical Magazine* might not also be made available in some degree to oversea Fellows as a compensatory benefit of Fellowship.

Another class of member to which I would like to refer briefly is that of our young Associate Members, small in number, but an important source of recruitment to our Fellowship, as recent elections have shown. In a Society like ours, Councils and Committees tend too often to contain only those of middle, or even of advanced, years, and tend therefore to lose contact with youth, to whom in time we must hand over our burdens. We must do more in the way of encouragement to our Associate Members.

The most recently instituted class of membership, the smallest of all, but of great, and I sincerely hope of increasing, importance, is that of our Corporate Members, which now includes some of the great commercial and industrial concerns in this country. Corporate Members have no representation on our Council for a reason which they readily understand, namely that our position as a Charity and a learned Society makes it essential that no commercial or industrial organization should have a predominant say in our affairs. It is on this account all the more important that we should establish a close contact with them, so that we may know of their needs and improve those facilities of special concern to them, notably the rapid provision of geographical information through the great resources of our Map Room and Library.

Our Society has many problems to face and difficulties to overcome. In a changing world we must be continually on the alert to keep abreast of, and even to anticipate, evolutionary progress. Janus-headed, we can look back on our past with pride, while looking forward to the future with undiminished confidence.

ON THE FREQUENCY OF GALES IN THE ARCTIC AND ANTARCTIC

H. H. LAMB

AN UNDERSTANDING of the distribution of occurrence of gales in relation both to the general circulation of the atmosphere in high latitudes and to commonly occurring geographical features in those regions is much needed for the guidance of expeditions and ships at sea.

DATA FOR THE ARCTIC (DAVIS STRAIT TO BARENTS SEA)

Figure 1 shows the geographical distribution of annual frequency of gales (Beaufort force ≥ 8) between Greenland and Novaya Zemlya, derived from monthly

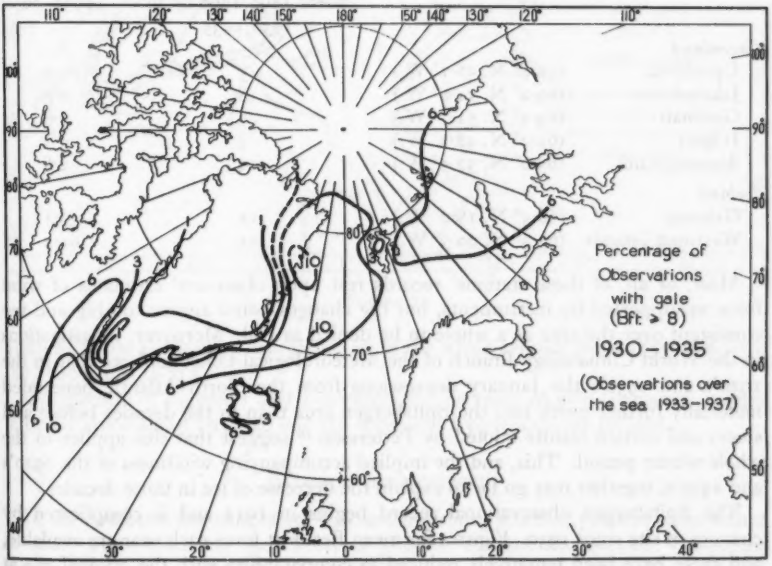


Figure 1

maps of the sea areas published in 1942 [1] for the years 1933–7 and based on ships' data available in the Meteorological Office. The data for individual months were sometimes too sparse to yield a clear picture, but the pattern of annual totals appears to be determined beyond doubt. Frequencies for the years 1930–35 at all the observing stations on land and on the islands had also been worked up from the respective yearbooks and expedition reports [2, 3, 4, 5]: these values made it possible to extend the isopleth pattern over land without difficulty. (The broken lines in north-east Greenland are partly based on the indications of marine data for 1933–7

and partly on the reports of the much later British North Greenland Expedition of 1952–4,[6] which agree in indicating a very windy regime in that area.)

It is now known that the foregoing map must be regarded as representative only of a period of years, at about the time of secular minimum extent of sea ice on the Arctic Ocean in the 1930's, which also corresponded to a maximum of windiness at most of the observing stations in the part of the Arctic here examined. The decrease of windiness since the 1930's has been greatest at the most northerly stations and least (or absent) at places nearest the main depression track from the south tip of Greenland to the Barents Sea. In southern Iceland windiness has increased at the same time as the decrease farther north.

The changes are illustrated by the figures in Table 1, which suggest that at many places the windy regime in Greenland must have dominated most of the early part of the present century. It is known however that at Godthåb in south-west Greenland there was a marked culmination of gale frequency in the years 1925–32.

TABLE 1.—*Number of days a year with storm (Beaufort force ≥ 9)*

		Long period mean[7, 8] *from about* 1890/1900 *up to* 1930/1935	*Mean*[9] 1938–50
Greenland			
Upernivik	(72·8° N. 56·1° W.)	5	0·9
Jakobshavn	(69·2° N. 51·0° W.)	8	0·8
Godthåb	(64·2° N. 51·7° W.)	9	3·8
Ivigtut	(61·2° N. 48·2° W.)	3	3·3
Angmagssalik	(65·6° N. 37·5° W.)	10	2·6
Iceland			
Grimsey	(66·5° N. 18·0° W.)	12	9·2
Westman Islands	(63·4° N. 20·3° W.)	34	61·2

Most, or all, of these stations' records rest upon observers' estimates of wind force unsupported by instruments, but the changes noted appear too big and too consistent over the area as a whole to be denied as real. Moreover, investigations in the World Climatology Branch of the Meteorological Office indicate that in the 1920's and 1930's the January depressions from the North Atlantic penetrated materially further north into the Spitsbergen area than in the decades before and since, and certain results quoted by Petterssen [10] suggest that this applies to the whole winter period. This, and the implied accompanying windiness of the 1920's and 1930's, together may go far to explain the decrease of ice in those decades.

The Spitsbergen observational record begins in 1912 and is complicated by changes of site since 1930. Figures for mean Beaufort force each year are available, and these have been tentatively reduced to comparability with the original site at Green Fjord (78·0° N., 14·3° E.). The results, grouped in similar years in Table 2, confirm the changes described in high latitudes and indicate 1919–40 as the period of maximum windiness at Spitsbergen.

TABLE 2.—*Average yearly wind force (Beaufort) at Spitsbergen (Green Fjord)*

Period	1912–18	1919–30	1931–34	1935–40	1947–53
Mean Beaufort Force ..	1·2	2·3	2·7	2·4	1·96

More recently the Marine Division of the Meteorological Office has computed the frequencies of gales in different parts of the same area, indicated by ships' data

for most of the period 1855–1954. These figures compare well with the frequencies indicated by land stations for the years 1945–9 and are so combined in Figure 2. Detail in this map has been drawn after reference to results of later expeditions and newer regular observing stations in Greenland as well as an analysis of observations from German trawlers off the south and west coasts.[6, 11, 12, 13] We must conclude that the observations of the period 1945–9 (and presumably of the years 1938–50

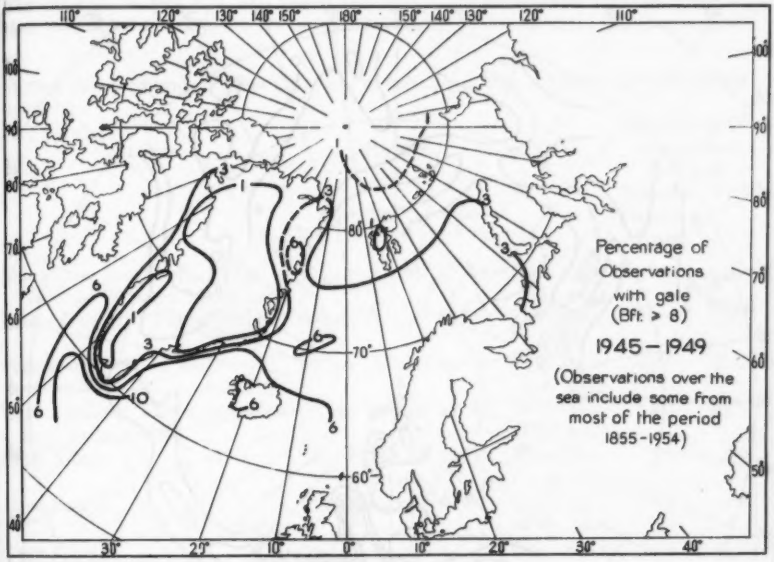

Percentage of Observations with gale (Bft. ≥ 8)
1945 – 1949
(Observations over the sea include some from most of the period 1855-1954)

Figure 2

given in Table 1) are more representative of the whole century since 1855 than were the 1920's and 1930's.

Comparison of Figures 1 and 2 confirms the decrease of gale frequency in high latitudes since about 1935–40 and the increased frequency over Iceland.

DATA FOR THE ANTARCTIC

In the Antarctic one cannot yet choose data from particular years in order either to study or to eliminate the effects of possible climatic fluctuations. One must simply use all data, from whatever year they are available, to derive a first glimpse at the overall pattern.

The available data on wind speed at the one Antarctic station with a long record, Laurie Island (60·7° S. 44·7° W.) [14], agree, however, with the figures for other elements at that point in indicating no significant climatic fluctuation since the early years of this century (see Table 3).

TABLE 3.—*Mean wind speed (year) at Laurie Island, S. Orkney*

Period	1906–15	1911–20	1921–30	1931–40	1941–50
Speed (Km./hr.)	17·7	17·1	17·7	17·1	17·8

Data from part, or all, of the period 1899 (the year in which man first landed on Antarctica) to 1954 have been used to map:

(i) the average number of days a year with gale (Bft.$\geqslant$8). This map which is representative of the whole year is not reproduced. Data fairly readily available enabled isopleths to be drawn over S. America south of 40° S., the Weddell Sea sector of Antarctic waters, and the coast between 0 and 70° W.; also over the Ross

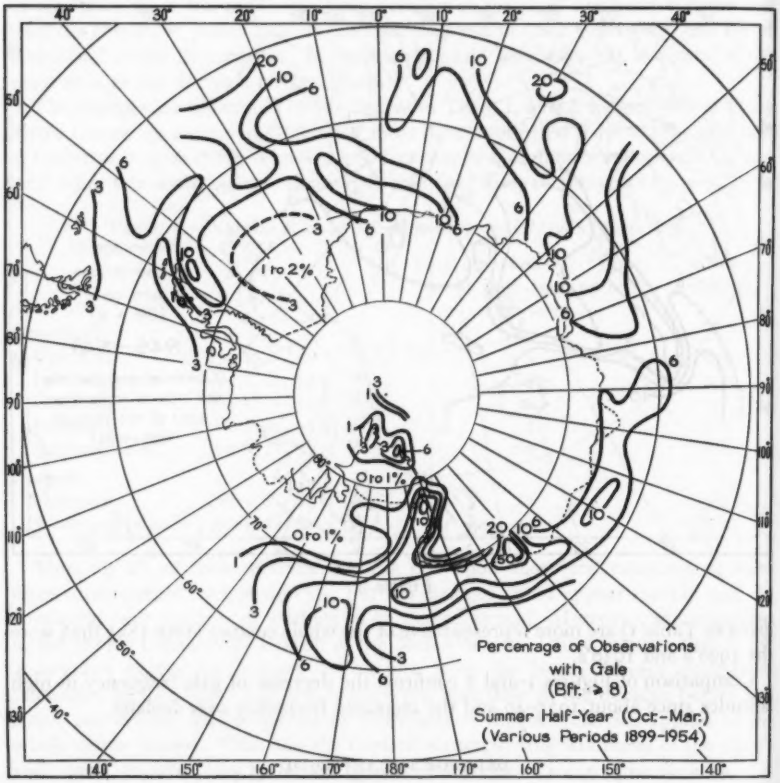


Figure 3

Sea and the coast between 90° E. and 160° W. In the Weddell Sea and Bellingshausen Sea frequencies of days with wind over 15 m./sec. reported by three ships beset in the ice (*Deutschland* 1911–12, *Endurance* 1915, and *Belgica* 1898–9) * were taken into account in the analysis.

(ii) the percentage of observations with gale during the summer half-year (October–March) reported by all known Antarctic expedition bases, all available sledge parties' logs (1899 to 1954) and the observations of ships at sea between 1949 and 1953 as analysed in Pretoria. The resulting map is here reproduced as

* *Belgica* was the only one in the Bellingshausen Sea, the other two were in the Weddell Sea ice.

Figure 3. This map shows no significant differences from the pattern of gale frequencies for the year as a whole, referred to under (i), which it confirms and amplifies.

The sources of data used in compiling Figure 3 are documented in the bibliography.[14–36]

Figures for Antarctic bases and sledge parties in the eastern sector of Antarctica between 138° E. and 160° W., which has been most extensively covered, are tabulated in Tables 4 and 5.

TABLE 4.—*Frequency of gales (Bft.* ≥ 8) *at expedition bases ashore in east Antarctica*

Station	*Position*	*Period*	*Percentage of observations with gale*	
			Summer (October–March)	*Year*
Shackleton Ice Shelf, "The Grottoes," Queen Mary Land	66° 18′ S. 95° 1′ E.	Apr. 1912–Feb. 1913	6·4	4·9
Pointe Géologie, Terre Adélie	66° 40′ S. 140° 1′ E.	Feb.–Dec. 1952	12·1	13·7
Port Martin, Terre Adélie	66° 49′ S. 141° 24′ E.	Feb. 1950–Jan. 1952	45·8	51·7
Cape Denison, Commonwealth Bay, Terre Adélie	67° 00′ S. 142° 40′ E.	Feb. 1912–Dec. 1913	54·4	65·1
Cape Adare	71° 00′ S. 170° 10′ E.	Mar.–Dec. 1911	1·7	4·6
Cape Royds	77° 34′ S. 166° 9′ E.	Mar. 1908–Feb. 1909	0·5	1·5
Cape Evans	77° 38′ S. 166° 24′ E.	Feb. 1911–Sept. 1912	10·9	15·7
Hut Point	77° 55′ S. 167° 01′ E.	Feb. 1902–Jan. 1904; Jan. 1911–Nov. 1912	0·6	0·8
Framheim	78° 38′ S. 163° 37′ W.	Apr. 1911–Jan. 1912	1·1	0·5
Little America	78° 34′ S. 163° 56′ W.	Feb. 1929–Feb. 1930; Feb. 1934–Feb. 1935; Feb. 1940–Jan. 1941	0·3	0·6
Byrd's "Bolling" Advanced Base	80° 07′ S. 163° 55′ W.	Mar.–Oct. 1934	0	0

A special analysis was also made of the gale frequencies indicated by the many expedition ships which have covered all parts of the Ross Sea. The distribution of gales within the Ross Sea shown in Figure 3 rests upon as much data as some parts of the surrounding ocean: altogether over 1600 ships' observations, well distributed between 65–79° S. and 160° E.–140° W. from the years 1911–13, 1929–30, 1934–5, 1950–1, were used.[19, 20]

TABLE 5.—*Frequency of gales (Bft.* ≥ 8) *experienced by Antarctic sledging parties*

Expedition	*Limiting positions of observations used*	*Dates of period available*	*Percentage of observations with gale*
Mawson's Western Parties ..	66½°–67½° S. 137–140° E.	Dec. 1912–Jan. 1913	38·8
Mawson's Western Parties ..	66½°–67½° S. 140°–142° E.	,,	33·3
Mawson's expedition, all parties	67°–68° S. 142°–144° E.	Nov. 1912–Jan. 1913	34·0
Mawson's Eastern Parties ..	67°–69° S. 144°–146° E.	,,	10·4
Mawson's Eastern Parties ..	67°–69° S. 146°–148° E.	Nov.–Dec. 1912	12·0
Mawson's Eastern Parties ..	67°–69° S. 148°–151° E.	Dec. 1912	5·5
David to S. Mag. Pole ..	70°–75° S. 155°–162° E.	Dec. 1908–Jan. 1909	0
Scott's Journey on the Western Plateau	77½°–78° S. 147–°160° E.	Oct.–Dec. 1903	0·7
Scott on Ferrar Glacier ..	77½°–78° S. 160°–167° E.	Oct.–Dec. 1903	6·1
Several parties S. of McMurdo Sound	79°–80° S. 161°–168° E.	Nov. 1902, Jan., Oct.–Dec. 1903	0·4
Scott and Shackleton	80°–82½° S. 161°–167° E.	Nov. 1902–Jan. 1903	0
Scott on Beardmore Glacier ..	83°–85° S. 165°–175° E.	Dec. 1911, Feb. 1912	8·0
Scott's Polar Party	85°–88° S. 159°–165° E.	Dec. 1911–Feb. 1912	0
Scott's Polar Party	88°–90° S. *circa* 160° E.	Jan. 1912	4·8
Amundsen's Polar Party ..	88°–90° S. *circa* 160° W.	Dec. 1911	0
Ditto, including ascent and descent of glacier	85°–88° S. *circa* 160° W.	Nov. 1911–Jan. 1912	2·2
Byrd's Parties	78°–79° S. 155°–160° W.	Sept.–Dec. 1934	0
Byrd's Parties	80°–82° S. 145°–165° W.	Oct.–Nov. 1934 Jan. 1935	0
Byrd's Parties	82°–85° S. 151°–159° W.	Nov.–Dec. 1934	2·5
Byrd's Parties	85°–87° S. 147°–152° W.	Nov.–Dec. 1934	0

CONCLUSIONS

(1) *The broadest regions of high frequency of gales* are out over the open water of the oceans, notably south of Greenland and Iceland and north of the Ross and Weddell Seas.

Although Figures 1 and 2 show no isopleth above 10 per cent., the frequency of days with gale at the North Atlantic Ocean weather ships I, 92 days/year, near 60° N. 15° W., and J, 117 days/year near 52° N. 20° W.[37], exceeds the frequency at any known point in the Southern Ocean. However, the number of days a year with gale at Cape Denison, Terre Adélie, 339, is unmatched; Cape Evans had

165 and Snow Hill (near Hope Bay), Graham Land, 141. Tables 6 and 7 in the Appendix give comparative figures of number of days a year with gale at a selection of the better exposed sites in the Arctic and Antarctic.

(2) As the figures just quoted also indicate, *the most intense maxima of gale frequency and the strongest gales* are at certain points on or near the fringe of Antarctica and Greenland:

(*a*) *The SSE'ly gales of the Terre Adélie* coast, which attain a unique frequency, locally exceeding 50 per cent., in 140°–145° E., between the steepest slope down from the ice cap near 68°–69° S. and the coast. This maximum extends to some degree into neighbouring longitudes on either side and also directly south on the almost level surface of the ice cap. Scott and David on approaching these longitudes from the east on the high ice cap in 70°–77° S. ran into evidence (form of the snow-dunes or *sastrugi*) that "over this part of the plateau blizzard winds from S. or S. by W. or SE. at times blow with great violence."

The gales of the Terre Adélie coast all blow from between S. and SE. and are sometimes very violent. This phenomenon was until lately unexplained, but can now be related with fair confidence to a large-scale channel orientated SSE. towards the Terre Adélie coast; this channel is between the S. Victoria Land mountains and high level ice near 160° E. and the main mass of the ice cap in east Antarctica with its summit apparently about 14,000 feet near 82° S., 55° E.[38,39] Whether the slope upwards on the western side of this elevated channel, from its floor about 7000 feet near 75°–80° S., 150° E., is anywhere at all steep is not yet known with certainty, but the channel is suitably placed to funnel the prevailing southerly wind around the Antarctic anticyclones centred in their usual position further west, and to catch much of the katabatic drainage of cold air off the South Polar plateau. The detail of how the strongest wind flow comes to be particularly concentrated on the stretch of the coast between 140° and 145° E. may be better understood when more of the detailed geography is known. A suggested explanation of the partial shielding of the coast, near Pointe Géologie close to 140° E. by local obstacles, has already been made by Wexler and Rubin.[40] If this is right, parts of the hitherto unvisited coast for some distance west of 137° E. may be swept fairly frequently by SE'ly gales associated with the same wind-stream.

(*b*) *Katabatic gales in mountain-girt, usually glacier-filled, valleys and fjords.* Antarctic examples are the Beardmore Glacier, Ferrar Glacier, Amundsen Glacier. The Beardmore Glacier, up which Shackleton and Scott went on their polar journeys in 1908 and 1911, seems to have been one of the worst, perhaps because it is so placed that the prevailing circulation around the anticyclones over east Antarctica is partly fed into this channel. There are similar examples in Greenland, especially east Greenland.

(*c*) *Gales blowing along mountainous sections of the coast.* Maxima of this nature are particularly important at the western fringes of the Ross and Weddell Seas and along the SE. coast of Greenland between 60° and 70° N., especially near Cape Farewell (Figs. 1 and 2). Other similar maxima are seen near the Antarctic coast (Fig. 3) in Dronning Maud Land (0°–20° E.) and Enderby Land (50°–60° E.), and south of Iceland at Westman Islands. These gales blow along the coast parallel with the mountain range in such a sense that the high pressure is over the ice caps and the low pressure out over the ocean.

These characteristic coastal gales, which are liable to reach force 12 (Beaufort), may be conveniently regarded as associated with a so-called "frontal funnel effect." They have often proved lethal, especially when accompanied by temperatures well

below the freezing point of sea water, so that boats and vessels become encrusted with ice above the water level. The conditions are such as commonly occur. Pressure is highest over the inland ice and a depression over the ocean drives relatively warm, maritime air masses towards the coast. The cold air previously present at the foot of the mountains continues to be fed by katabatic drainage off the inland ice. The situation between this air and the approaching maritime air masses is frontogenetic even if no front exists already. In the great majority of cases an already present warm front or warm occlusion is approaching the coast and becomes sharpened. The front is eventually halted by ageostrophic components in the cold air accelerating in the narrowing corridor between the front and the coastal mountains. The alignment of front and mountain range forms the shape of a funnel, by which the dangerous situation may be readily recognized. The illustration in Figure 4 shows gales of this sort near Cape Farewell at the south tip of Greenland: the diagram is due to Rodewald.[13]

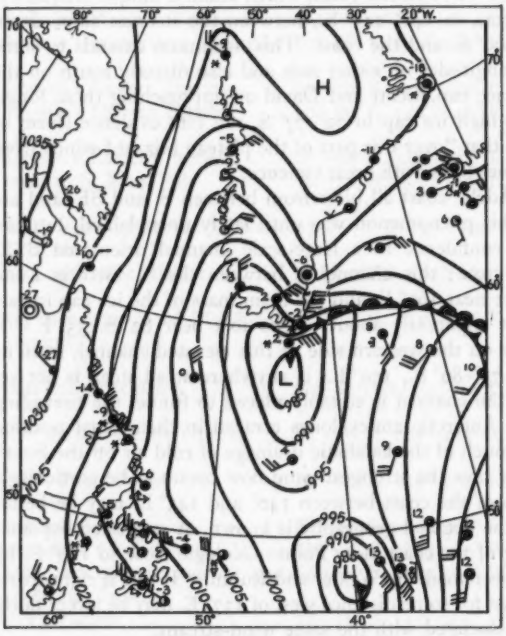


Fig. 4. "Frontal funnel" gales between the mountains of south Greenland and an approaching occlusion. (Numbers entered beside wind and weather data plotted at ships and land stations are air temperatures in degrees Celsius.) Situation on 8.1.1953 at 18h. G.M.T. Reproduced by courtesy of the Deutscher Wetterdienst (Seewetteramt, Hamburg).

In cases of frontal funnel gales, the paradox arises that lighter winds are to be found out over the ocean beyond the front. Apart from this there is only precarious shelter in localities amongst the coastal mountains. The apparently more exposed parts of the coast on extensive flat ice away from the mountains are much less liable to gales as are also the highest parts of the ice caps.

Graphic accounts of the violence of the coastal gales in Antarctica and Greenland have been given by various writers.[4, 17, 34] Especially worthy of note are the sharp boundaries between sheltered localities, for instance in side valleys, and points exposed to the full violence of the storm, also the occasional abrupt lulls during which a flat calm or a light contrary breeze may be experienced while the storm continues unabated overhead and near by on the ice cap.

(3) *Minima of gale frequency are found in the central and south-eastern portions of the Ross and Weddell Seas*, where the coast is low, *and in the corresponding portion of the Bellingshausen Sea*, where a strongly curved arc of mountains probably hinders penetration of the area by gales blowing along the flank of the range from the section farther north-east (Fig. 3). NE'ly and ENE'ly winds are prominent on all these coasts in conformity with the mean pressure map; this direction is in some opposition to the cold air drainage off the ice cap in these sectors, which doubtless has much to do with the relatively moderate winds.

This effect and the open exposure away from any steep slopes give the eastern part of the Ross Ice Shelf, near Amundsen's base at Framheim and Byrd's Little America, a much less windy climate than the area of McMurdo Sound, used by Scott. Halley Bay, east of the Weddell Sea, appears to some extent similarly favoured.

There is probably a parallel to this in the minima of gale frequency along much of the west coast of Greenland, east of Baffin Bay and Davis Strait (Figs. 1 and 2).

A NOTE ON TEMPERATURE

Rising wind force tends to destroy the surface inversion and normally raises surface temperatures materially above their previous values, but expeditions should note the still very low temperatures occurring in gales which are fed by katabatic drainage of cold air off the Antarctic and Greenland ice caps. Temperatures below −15° C. are observed with winds of gale force in both areas. At Commonwealth Bay, Terre Adélie, the dry bulb temperature during most gales was between −15° and −25° C. On the South Polar Plateau in summer (7–9 January 1909) Shackleton experienced −40° C. with a wind of gale force.

Acknowledgement.—I am indebted to the Director of the Meteorological Office for leave to publish this article.

APPENDIX

Gale frequencies at representative sites in the Arctic and Antarctic

TABLE 6.—*Estimated number of days a year with gale (Bft.* ⩾ 8) *at selected Antarctic base sites*

Site			*Period*	*Number of days a year*
Marguerite Bay	68·2° S.	67·0° W.	1946–49	29
Port Lockroy	64·8° S.	63·5° W.	1944–48, 1950	35
Admiralty Bay	62·0° S.	58·4° W.	1948–50	27
Hope Bay	63·4° S.	57·0° W.	1945–48	63
Snow Hill	64·4° S.	57·0° W.	1902–03	141
Shackleton	77·9° S.	37·3° W.	1956 (6 months)	49 days in winter half year
Halley Bay	75·5° S.	26·6° W.	1956 (6 months)	26 days in winter half year
Maudheim	71·0° S.	10·9° W.	1950–52	40
Gauss	66·0° S.	89·6° E.	1902–03	69
Cape Denison	67·0° S.	142·7° E.	1912–13	339
Cape Adare	71·3° S.	170·1° E.	1899–1900	72
Cape Royds	77·6° S.	166·1° E.	1908–09	36
Cape Evans	77·6° S.	166·4° E.	1911–12	165
Hut Point	77·9° S.	167·0° E.	1902–04	40
Framheim, Little America	78·6° S.	163·7° W.	1911–12, 1929–30, 1934–35	23

TABLE 7.—*Number of days a year with gale (Bft.* ≥ 8) *at a few Arctic stations for comparison*

Site	Period	Number of days a year
Upernivik	70·8° N. 56·1° W.	1938–50	3
Godthåb	64·2° N. 51·7° W.	1938–50	14
Angmagssalik	65·6° N. 37·6° W.	1938–50	9
British Arctic Air Route Expedition: main base (16 m. a.s.l.) ..	65·6° N. 38·7° W.	1930–31	42
Ditto: ice cap station (2500 m. a.s.l.)	67·1° N. 41·8° W.	1930–31	9
British North-east Greenland Expedition: main base (Britannia Sø) (223 m. a.s.l.) ..	77·2° N. 23·6° W.	1952–54	76
Ditto: ice cap station (Northice) (2525 m. a.s.l.)	78·1° N. 38·5° W.	1952–54	7
Eismitte (3000 m. a.s.l.) ..	70·9° N. 40·7° W.	1930–31	2
French central ice station ..	70·9° N. 40·6° W.	1949–50	14
Jørgen Brønlundsfjord / Peary Land ..	82·2° N. 30·5° W.	1948–50	20
North Pole (Russian ice drift station)		1954–55	1

BIBLIOGRAPHY

[1] Monthly meteorological charts of the Greenland and Barents Seas. M.O. 575. Meteorological Office, London, 1942.

[2] Danish meteorological yearbooks: Part 2, Greenland (Danske Meteorologiske Aarbøge: 2nen del Grønland). Copenhagen, 1911–50.

[3] Norwegian meteorological yearbooks. Christiania (Oslo), 1912–53.

[4] Mirrlees, S. T. A., "Meteorological results of the British Arctic Air Route Expedition 1930–31." M.O. Geophysical Memoir, No. 61, London, 1934.

[5] Wegener, K., "Wissenschaftliche Ergebnisse der deutschen Grönland Expedition, Alfred Wegener, 1929–31," Band IV, Teil 1. Leipzig, 1933.

[6] Hamilton, R. A., 'British North Greenland Expedition 1952–54: meteorological results.' (Publication pending.)

[7] 'Arctic Pilot,' Vols. II and III, Admiralty, London, 1949 and 1947 respectively.

[8] Veðráttan Islaendi (Iceland meteorological yearbooks). Reykjavik, 1936–51.

[9] Meteorological Office, Marine Division (atlas data) 1954 (unpublished).

[10] Petterssen, Sv., "Changes in the general circulation associated with the recent climatic variation." *Geogr. Ann. Stockh.* **6** (1949), pp. 212–21.

[11] Fristrup, Børge, "Physical geography of Peary Land: I, Meteorological observations for Jørgen Brønlunds Fjord (82·2° N., 30·5° W.)." *Medd. Grøn*, **127**, 4 (1952). Kommissionen for Videnskabelige Undersøgelser i Grønland, Copenhagen.

[12] Expéditions Polaires Françaises: "Observations météorologiques de la Station Française du Groenland" (70° 55′ 03″ N., 40° 38′ 22″ W.). Paris, 1954.

[13] Rodewald, M., "Klima und Wetter der Fischereigebiete West- und Süd- Grönland." Beiträge der Wettergeschehen in den nordeuropäischen Gewässern (Nr. 3). Seewetteramt, Hamburg, 1955.

[14] "Datos climatológicos y geomagnéticos: Islas Orcadas del Sud periodo 1903–50." Servicio Meteorológico Nacional, Buenos Aires, 1951.

[15] "Anales climatológicos: 1928–37, 1942–44." Servicio Meteorológico Nacional, Buenos Aires 1946–52.

[16] Knoche, W. Anuario Meteorológico de Chile (Meteorologisches Jahrbuch für Chile), 1911 ff., Santiago (Instituto Central Meteorológico y Geofisico de Chile), 1912 ff.

Observations from ships at sea in the far south:

[17] Meinardus, W. 'Klimakunde der Antarktis.' Köppen und Geiger: Handbuch der Klimatologie Band IV, Teil U. Berlin, 1938.

[18] Vowinckel, E., and C. M. Oosthuizen, "Weather types and weather elements over the Antarctic ocean during the whaling season." *Notos*, **2** (1953), pp. 157–82. Pretoria, 1953.

(This gives percentage frequency of gales over the ocean areas 50°–70° S., 50° W. through 0° to 160° E. based on 16,500 ships' observations during four summers—November to March—1949 to 1953.)

[19] Observations from ships of Scott's Expedition 1911–13 and Byrd's Expeditions 1929–30 and 1934–5: published in 'British Antarctic Expedition 1910–13,' Calcutta, 1919, and *Mon. Weath. Rev., Wash.*, Supplements Nos. 41 and 42, 1939 and 1941. (These sources yielded 1455 ships' observations between 65° and 79° S., 160° E. and 116° W.)

[20] Hanzawa, M. K., Okabayashi, K. Yoshida and R. Marumo, "Report on sea and weather observations on the Antarctic whaling ground 1950–1." *Oceanogr.* 3, 4 (1951), pp. 107–37, Tokyo. (This source yielded 376 ships' observations between 60° and 70° S., 160°–180° W.)

Observations from Antarctic bases:

[21] Pepper, J., 'Meteorology of the Falkland Islands and Dependencies 1944–50.' Crown Agents, London, 1955. (3 to 7 years' data.)

[22] Original Maudheim data (unpublished) supplied by courtesy of Norsk Polarinstitutt, Oslo, by hand of Instr. Cdr. G. P. Britton, R.N. (22 months' data).

[23] Expéditions Polaires Françaises (Missions Paul-Émile Victor): Expéditions Antarctiques (Terre Adélie): "Conditions en surface: Port Martin (fascicules I, II et III), Pointe Géologie." Relevés quotidiens et commentaires. H. Boujon, A. Prudhomme, R. le Quinio and G. Lépineux. Paris, 1954–5. (Observations 1950–52.)

[24] Kidson, E., 'Australian Antarctic Expedition (Mawson) 1911–14. Scientific Reports,' Series B, Vols. IV, V, VI. Sydney (Government Printer), 1929–46.

[25] Grimminger, G., W. C. Haines and A. Court, *Mon. Weath. Rev., Wash.*, Supplements 41 (1939), 42 (1940) and 48 (1949). (Data for Little America 3 years; also Bolling Advanced Base 8 months; sundry sledge journeys and ships' voyages.)

[26] Mohn, H., 'Roald Amundsen's Antarctic Expedition 1911–12: Scientific results, Meteorology.' *Skr. Vidensk. Selsk., Christ.*, No. 5 (1915).

[27] 'National Antarctic Expedition (Armitage) 1901–4. Meteorology.' Part I, London (Royal Society), 1908. (Data for McMurdo Sound bases: 2 years.)

[28] Kidson, E., 'British Antarctic Expedition (Shackleton) 1907–9: Meteorology.' Melbourne (Council for Scientific and Industrial Research), 1930.

[29] Simpson, G. C., 'British Antarctic Expedition (Scott) 1910–13, Meteorology,' Vol. III: Tables. London (Harrison: Scott Fund), 1923. (Data for McMurdo Sound bases: 2–3 years, also for Cape Adare, 1 year.)

Observations from Antarctic sledge journeys:

Data from journeys by Mawson's parties are logged in [24] above. Data from Scott's, Amundsen's and Byrd's parties are found in [27, 28, 29, 26, 25]. Some details of a journey by Fuchs in the Graham Land sector are given in [21].

The following narratives have also been consulted:

[30] Bernacchi, L. C., 'To the South Polar regions.' London, 1902. (Narrative of Borchgrevink's "Southern Cross" Expedition, including the first party ashore in Antarctica at Cape Adare. Well illustrated by sketches and maps and a few scientific results.)

[31] Armitage, Lieutenant A. B., R.N.R., 'Two years in the Antarctic.' London, 1905.

[32] Scott, Robert Falcon, 'The voyage of the *Discovery*.' London, 1905. (Account includes diary of journey on the western plateau to 147° E.)

[33] Shackleton, E. H., 'The heart of the Antarctic.' London, 1909. (Includes Shackleton's diary of his attempt on the South Pole, reaching 88° S., also Professor T. W. E. David's diary of his journey to the South Magnetic Pole over the western plateau.)

[34] Mawson, Douglas, 'The home of the blizzard.' London, 1916. (Account of journeys in Terre Adélie near the coast and towards the Magnetic Pole.)

[35] Amundsen, Roald, 'The South Pole.' London, 1912.

[36] 'Scott's last expedition,' by members of the expedition. London, 1913. (Reports of journeys from the diaries of Scott, Wilson and surviving members of the expedition.)

[37] Hay, R. F. M., "Five-year means of meteorological observations made at the ocean weather stations I and J 1948–52." Met. Res. Paper 923, Air Ministry, Meteorological Research Committee, London, 1955.

[38] Byrd, Admiral Richard E., U.S.N. retd. "All-out assault on Antarctica," *Nat. geogr. Mag.* 110 (1956), pp. 141–80 (esp. p. 159).

[39] Siple, Paul A., "Antarctic geography" in 'Antarctica and the International Geophysical Year.' American Geophysical Union, Washington, 1956.

[40] Wexler, H., and J. Rubin Morton. "Antarctic climatology and meteorology," in 'Antarctica and the International Geophysical Year,' pp. 36–43. Washington, 1956.

SOME GEOGRAPHICAL ASPECTS OF THE BRITISH SOLOMON ISLANDS IN THE WESTERN PACIFIC

J. C. GROVER

I HAVE BEEN engaged in geological exploration of the Solomons for several years—years with never a dull moment—but I had been there for two years or so before I realized that much of what I had been seeing had not been previously recorded in publications. The realization came slowly that activity by missionaries and administrative officers had so largely been confined to the accessible coastlines and centres of population. Even the Japanese war had been confined almost entirely to coastal plains and foothills, though patrols crossed the mountains along the village trails. Our work took us to less known parts, as the only fresh rock exposures are to be found in the rivers themselves. My colleagues and I have found ourselves in parts which had not even been visited by the living generations of islanders: for, as a result of some discoveries, such as hot springs, wise old men have apparently suffered loss of face with the younger generation.

The double chain of the British Solomon Islands lies about 1200 miles to the north-east of Australia. Excluding Australian Mandated Bougainville in the extreme west, they stretch away in a south-easterly direction for about 1000 miles, and include the scattered islands of the Santa Cruz group in the east. Several major islands are about 100 miles long and 20 to 30 miles wide, with high and rugged mountains—in the case of Guadalcanal rising to 8005 feet above the sea. A United Kingdom Protectorate, the islands are the responsibility of the Colonial Office, and are governed by the High Commissioner for the Western Pacific, stationed in Honiara, the growing post-war capital adjoining Point Cruz on the northern coast of Guadalcanal.

The climate is tropical and not unpleasant; there is usually a sea breeze by day and a cool land breeze from the mountain ranges at night, when temperatures on the Honiara township ridges are between 68° and 73° F. Day temperatures average between 85° and 91°, and humidity is high. The islands are nearly all covered with dense jungle. The rainfall in the mountainous areas is heavy and measured in hundreds of inches per year. As the large rivers have extensive headwater catchments they tend to flood with little warning in the lower reaches; but also tend to fall rapidly when rain ceases. In the mountain country it rains in the afternoons of most days. Rain is sometimes signalled by approaching rain-cloud fronts bringing wind-squalls—though these are usually of short duration. The Solomons region is that of the "young hurricanes" which form hereabouts and pass south-eastwards to the New Hebrides, New Caledonia or Fiji areas where they do so much more damage. It is only very occasionally (as in January 1952) that these malevolent cyclones of relatively severe intensity, and their tides, affect the Central and Western Solomons. The north-west monsoon season is usually one of calm, punctuated by north-westerly "blows" between November and April, when heavy rain may immobolize field parties for days at a time. May to November marks the season of the south-east trades, and of the fine weather, although there are wet periods during this season too.

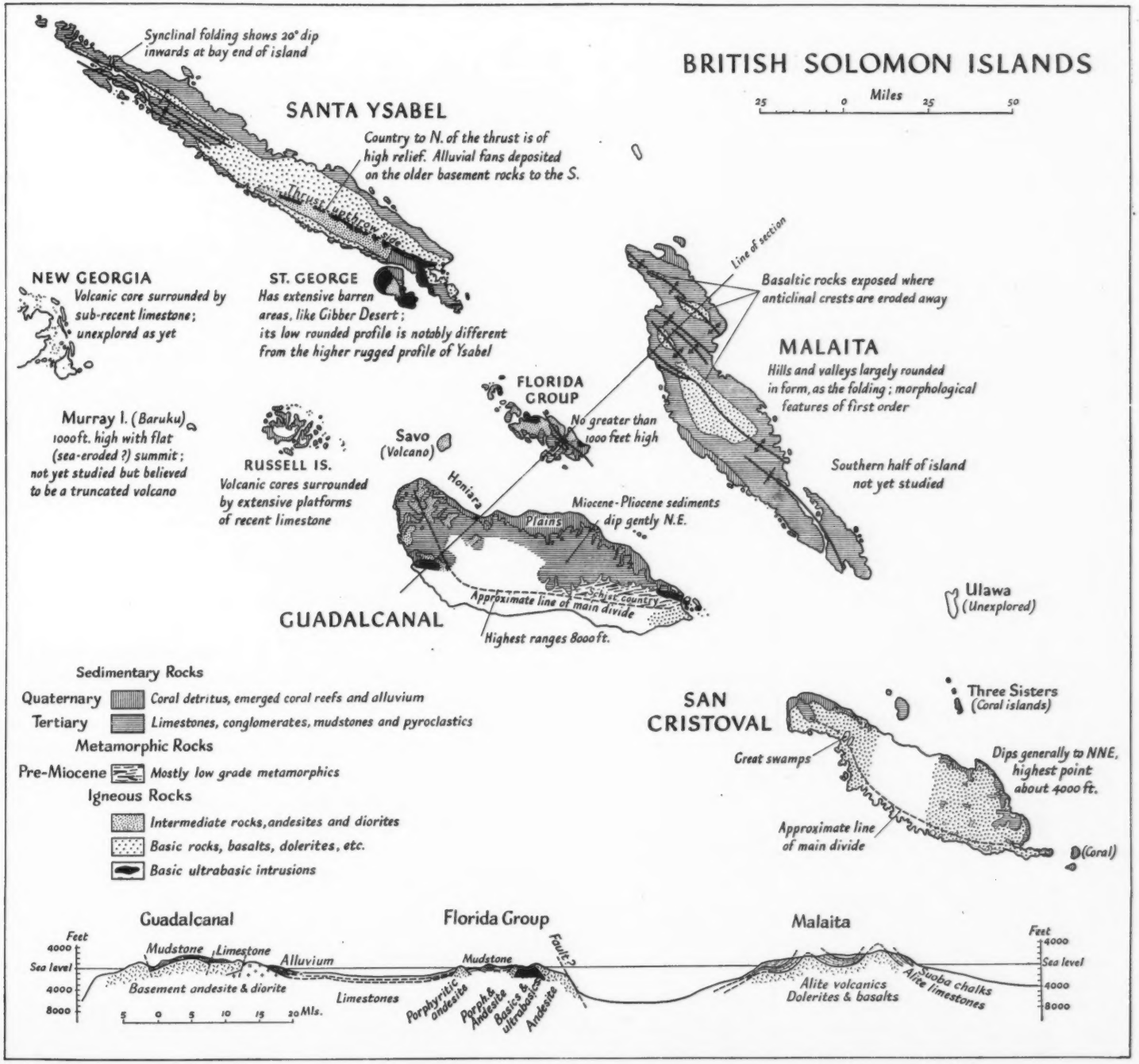

BRITISH SOLOMON ISLANDS
Miles
25 0 25 50
SANTA YSABEL
Synclinal folding shows 20° dip inwards at bay end of island
Country to N. of the thrust is of high relief. Alluvial fans deposited on the older basement rocks to the S.
Thrust
NEW GEORGIA
Volcanic core surrounded by sub-recent limestone; unexplored as yet
ST. GEORGE
Has extensive barren areas, like Gibber Desert; its low rounded profile is notably different from the higher rugged profile of Ysabel
Line of section
Basaltic rocks exposed where anticlinal crests are eroded away
MALAITA
Hills and valleys largely rounded in form, as the folding; morphological features of first order
Southern half of island not yet studied
FLORIDA GROUP
No greater than 1000 feet high
Murray I. (Baruku)
1000ft. high with flat (sea-eroded ?) summit; not yet studied but believed to be a truncated volcano
RUSSELL IS.
Volcanic cores surrounded by extensive platforms of recent limestone
Savo (Volcano)
Honiara
Plains
Miocene-Pliocene sediments dip gently N.E.
Hilly country
Approximate line of main divide
Highest ranges 8000 ft.
GUADALCANAL
Ulawa (Unexplored)
Sedimentary Rocks
Quaternary
Coral detritus, emerged coral reefs and alluvium
Tertiary
Limestones, conglomerates, mudstones and pyroclastics
Metamorphic Rocks
Pre-Miocene
Mostly low grade metamorphics
Igneous Rocks
Intermediate rocks, andesites and diorites
Basic rocks, basalts, dolerites, etc.
Basic ultrabasic intrusions
SAN CRISTOVAL
Three Sisters (Coral islands)
Great swamps
Dips generally to NNE, highest point about 4000 ft.
Approximate line of main divide
D (Coral)
Guadalcanal
Florida Group
Malaita
Feet
4000
Sea level
4000
8000
Mudstone
Limestone
Alluvium
Basement andesite & diorite
Limestones
Mudstone
Fault?
Porphyritic andesite
Porph. & Andesite
Basics & ultrabasic Andesite
Alite volcanics
Dolerites & basalts
Suoba chalks
Alite limestones
5 0 5 10 15 20 Mls.

Figure 1

Agriculture.—The alluvial plains of Guadalcanal offer perhaps the finest potential for settlement in the Solomons. There are well over 100,000 acres of flat, well-matured, unused land within about an hour's drive from Honiara, and possessing a network of good roads built during the Japanese war. There is considerable inherent fertility in the soils, which have been derived from the mountains whose rocks are largely volcanic in origin; past experience of the Agriculture Department, the Marist Brothers' farm at Tenaru, Levers Estates, and the Sisters at Tetere Leprosarium, has combined to confirm the fact of inherent soil fertility. During the last few years I have seen maize, dry rice, sweet potatoes, panna, tomatoes, beans, sugar and other crops; and the recent experiments by the Marist Brothers in the growing of wet rice have been most spectacular, though, as with other projects in the Solomons, development has been sadly limited by lack of capital. Rice is at present imported into the territory. During the last war large quantities of fresh vegetables were produced for the Allied forces by organized farming at Ilu. A portion of the area was carried on as a Government Experimental Farm until 1954 when it was closed because of staffing difficulties. The Protectorate's economy is almost entirely based on copra at present. Coffee, cocoa, sugar, rice, rubber, cotton, peppers, fibres and other products have been grown successfully, but not on any scale. The largest operating company in the Protectorate is the Levers Pacific Plantations Pty., Limited, but only a small proportion of the freehold land is planted, and some of that has been abandoned since the war, partly because of insufficient European supervision, and partly because of the shortage and indolence of labour, and rising costs.

In partnership with Levers, the Government has recently been investigating the cocoa-growing potential on Kolombangara in the Western Solomons. The area selected was extensive flat jungle-covered country of promising appearance, adjoining the splendid Bat Harbour. Soil samples were taken and forwarded to the Royal Netherlands Tropical Institute in Holland for analysis; but these unfortunately showed the entire area to be too infertile for cocoa-growing. Asked to explain why, we were able to show that the area had been covered by a great mud-flow from the cleft in the Kolombangara crater, probably during the final spasm of its activity in quite recent times. The soils everywhere on the island, derived from the older flow and pyroclastic rocks, proved very fertile indeed, but all this other fertile country is deeply dissected and very rough, and lacks a good harbour. The islanders practise subsistence agriculture universally, opening up new gardens by clearing and burning the jungle when the soil fertility is exhausted in the old gardens—the so-called "shifting" cultivation.

The people.—The population of the Solomons consists of about 95,000 islanders, and a few hundred each of Europeans and Chinese. The islanders are Melanesians except on the remote outlying atolls and islets where the Polynesian invaders settled. About half the population is concentrated on the island of Malaita. It is not possible to generalize on Melanesians any more than with Europeans—there are some splendid types of men, some indifferent, and many poor. The skin colours vary from a light coppery colour, through every shade to black. The islanders are generally intelligent, and in some ways quicker on the uptake than some Europeans: they are usually good judges of character, and, not being confused by the veneers and complexities of civilization, are able quickly to sum up a European from his manners and behaviour, and will exploit him to the full. In the light of my own observations I find it difficult to believe that the boot was ever on the other foot. They are, generally speaking, independent,

stolid and loyal; and quite naturally make allowances for the idiosyncrasies of human nature. They are apt to judge a man by what he is and not by his colour.

The beach-dweller will rarely undertake strenuous tasks of long duration, and he generally dislikes the long hard effort of climbing through the cold, wet, rain forest in the high mountains. Therefore it is necessary to call on the more vigorous people from the mountainous regions when exploration work is to be undertaken. They like it, and think little of a heavy climb; sometimes they comment that a large load is better because it keeps one warm. They have immense reserves of energy and humour and will still be laughing when a European has reached the stage when his nerve-ends are dragging along the ground. They are small and wiry people—young men who might not look exactly robust by European standards have surprising stamina—and can carry heavy loads without apparent effort. Usually 40 pounds is the maximum: to those who think this is heavy, it is well to think of those armies of Europeans who, a few years ago, carried 70 pounds and heavier loads under so much more difficult and dangerous conditions, in a jungle element as fearful and foreign to them as it is familiar and friendly to the men of the mountains of Guadalcanal.

The first geographical expeditions.—I have not time to tell you of the incredible voyages of discovery by Mendaña from Peru in 1568 and 1595—the second expedition is robustly written up in Graves' 'Isles of unwisdom.' The Spaniards kept their discoveries secret so as not to help Sir Francis Drake, and for nigh 200 years the islands were lost to Christendom, until rediscovered by Carteret. The tragic end of La Pérouse on Vanikoro, the death of Commander Goodenough, R.N., the martyrdom of Bishop Patteson, the massacre of Lieutenant Bowers, R.N., and the men of H.M.S. *Sandfly*, the well-documented observations of Dr. H. B. Guppy in 1881 and 1882 while surgeon with H.M.S. *Lark*—all of these are sagas in themselves. It is to the hydrographers of the Royal Navy that we owe most of our earlier knowledge of the Solomons. For they were not only responsible for the only general charts and maps available up to 1942, but their officers, in many cases, played a great part in the enlightened pacification of the people before the missionaries arrived. Their job was not easy and some found their last resting place in the Solomons. Guppy's work remained virtually the only published source of geological and geographical information of a general nature for nearly seventy years—until 1955.

I would like to mention in passing the ill-fated *Albatross* Geographical Expedition from Vienna, some of whom were massacred at the end of their five days' trek into Guadalcanal to climb the sacred mountain Tatuve. They were surrounded by hostile cannibals while having breakfast at dawn. But, as "great pity was felt for the white men who were about to die" it was felt that the least they could do was to let them fight on a full stomach, and the cannibals waited: this, according to the last survivor of those who took part in the attack, a very old man whom I interviewed near Tatuve in 1950. After the white men had split up into two parties they were attacked without warning by overwhelming numbers wielding battle-axes with deadly effect. The Europeans fought with their bare hands to gain the centre of the camp where their arms were piled—one gallant matelot hurled his attackers one by one over the precipice until he also was cut down. Their brave leader and chief geologist, Foullon, refused medical attention so that his matelots might receive it, and died that night without a word of complaint in the arms of his lieutenant. It was four years ago, while visiting Innsbruck University, that I

finally found the detailed report.[1] My interest had been aroused by finding a memorial in the jungle on the north coast of Guadalcanal in 1950. The memorial reads in German: "In Memory of the members of the Expedition who died in the battle at the foot of the Mountain Tatuve. The heroic fallen in the cause of science. From the expedition of His Majesty's Ship 'Albatross' from the King and Kaiser's Navy, 1896." On the reverse side are the names of the five, headed by the name of Heinrich Foullon von Norbeeck, Chief Geologist. I was also met by a deputation at the foot of Mount Tatuve on the site of the battle, and like Foullon, fifty-four years before, was asked courteously but firmly not to climb the sacred mountain Tatuve. It is important to observe that this incident effectively discouraged exploration and prospecting for thirty-five years—until 1931 when gold was found by botanist Kajewski.

Geological exploration in the Solomons began in 1950 when one geologist was appointed: Since 1954 three geologists have been operating, and this has been supplemented by expeditions from the University of Sydney, all sponsored by the Colonial Development and Welfare Fund. The first comprehensive Memoir was published in London in 1955, and a second should be published at the end of 1957.

Geography of the Solomons

I shall begin by describing briefly the islands of the easternmost part of the Protectorate and the outlying atolls, and then converge naturally on the central Solomons about which we are now learning a great deal. It will be appreciated that a detailed account could be written about each island's individual characteristics, for some owe their origin to no single common event or circumstance. In some cases the fundamental geological differences are quite remarkable—as are those of fauna, and even flora (see Figs. 1 and 8).

The Santa Cruz Group.—The islands of the Santa Cruz Group in the extreme east are all volcanic in origin with the exception of the Swallow sub-group which are of coral growth entirely, some eroded strangely by the sea since their emergence. There are many extensive reef growths and many sand cays widely separated, each on a distinct coral pinnacle rising from deep sea. There has been extensive barrier reef development at Vanikoro and Utupua, both of which have been used as classical examples to illustrate Darwin's theory of atoll formation.

Tinakula Volcano is known to have been active off and on for nearly 400 years —since first seen by Mendana's second expedition in 1595. The handed-down story of destruction of the population in a glowing cloud eruption in the 1840's has been told to me vividly by the descendant of a family who were fortunately absent on an adjoining island. In the Duff Group the Polynesian people have built an artificial island of boulders off the coast of Taumako or Disappointment Island. Santa Cruz itself is the largest island and only the western half has been explored —around the quiet waters of Graciosa Bay is an extensive plateau of white limestone 450 feet high, built out to the westward from the volcanic part of the island.

Outlying coral islands peopled by Polynesians.—Away towards the Pacific from the northern side of the Solomons chain are the coral Stewart or Sikaiana Islands, east of Malaita. 150 miles north of Santa Ysabel lie the islands of the great Lord Howe Atoll. These coral outliers are peopled by Polynesians. A similar distance south of Guadalcanal are the Polynesian islands of Rennell and Bellona, which

[1] Mauler J.v. und Wilh. Kesslitz, 'Die Missions-Reise S. M. Schiff "Albatros" 1895–1898,' *Abh. geogr. Ges. Wien* I (1899) pp. 373–438.

have been the subject of studies by the Danish scientists Birket-Smith and Wolff of the *Galathea* Expedition in 1951, the Bradley Expedition from the British Museum in 1954, and myself in 1956. They are classical examples of emerged coral atolls and are worthy of brief individual treatment (see Fig. 2).

Rennell—the great uplifted atoll on the edge of the Coral Sea.—This southernmost island in the Protectorate is probably the finest known example of an uplifted

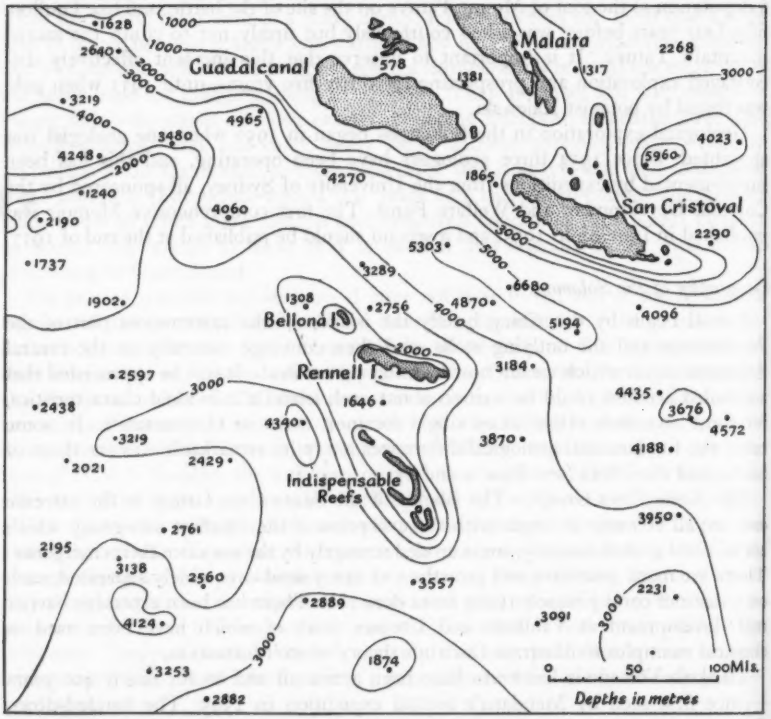


Fig. 2. Bathymetric map of the regions surrounding Rennell and Bellona

atoll (see Figs. 3 and 4). It is 49½ miles (79·8 kilometres) long ESE.–WNW., and to 8½ miles (13·65 kilometres) wide, being emerged to a height of 360 feet (110 metres) above sea level. The elevated Lake Te-Nggano at its eastern end is the largest expanse of enclosed fresh water in the Pacific, being 50 square miles in extent. Rennell is composed of coral limestone with minor phosphatic enrichments here and there. On rare occasions, igneous rocks may be met with which have drifted ashore from distant islands in the roots of floating trees and which are subsequently used for artifacts like axe heads or the adze. Igneous pebbles have also been transported from larger islands in the bellies of ducks and other birds. Such pebbles were found in ducks shot by Dr. Torben Wolff, and sent me for examination in 1952. The earlier Polynesian conquerors from distant Uvea in the mid-Pacific also brought with them basic igneous rocks which assumed a religious

significance on Rennell as they were different to the ubiquitous white limestone; these sacred stones were smashed and scattered by missionaries in recent years. Rennell itself stands as a memorial to the industry of the tiny coral polyp.

Both Bellona and Rennell have emerged, initially by crustal anticlinal folding, and in more recent times by pulsating vertical uplift of the sea bed. The successive

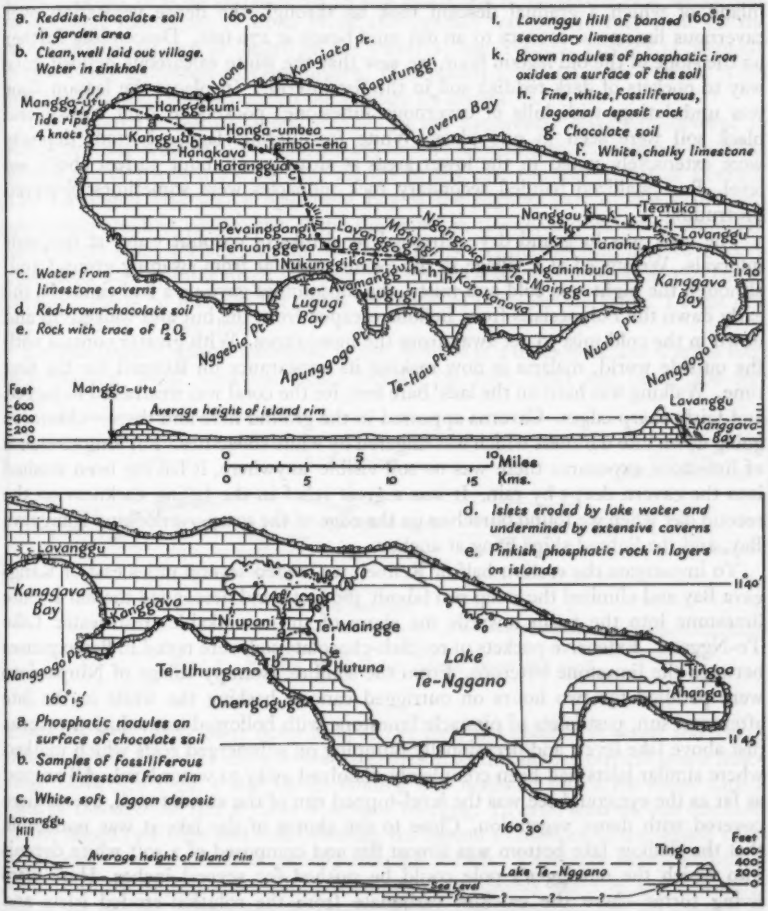


Fig. 3 (above). Rennell Island, west
Fig. 4 (below). Rennell Island, east

horizontal etchings testify to these latter movements; they are approximately horizontal, as is the rim of the island. The earlier "doming movement" is suggested by the profile of the island interiors. Bellona slopes westerly, Rennell easterly; and yet the islands are similarly oriented in the same current, and subject to the same factors responsible for coral growth.

We landed at the north-west extremity of Rennell; the barrier reef and the shallow, narrow lagoon gave way to sea-etched caverns to an estimated 8 feet, with another eroded scarp at 30 feet. After steep climbing, barrier reef crests were recognized at 210 feet, 270 feet, and 320 feet; each of them backed by a pronounced old lagoonal depression. The rim summit was at 360 feet, beyond and inland of which a gradual descent took us through the dense vegetation over cavernous limestone country to an old sand beach at 270 feet. Descending further on the slope of the old lagoon floor, we saw that the white calcareous deposit gave way to pockets of dark reddish soil in the flat interior. In places the lagoon floor was undulating, with hills of cavernous limestone: pockets of dark brown and black soil were seen in one place. White fossiliferous lagoon-bottom deposits were extensively noted in the lower areas at altitudes of about 50 feet above sea level. Recrystallized banded secondary rock pinnacles were sometimes observed protruding.

The walk was long and dry, refreshed by drinks of coconut water at frequent intervals. We stayed at a village in the evening not far from swampy ground and, although the night was cold and misty, the mosquitoes gave us a bad time. In the early dawn the Polynesians from Bellona escaped from the hut and walked up and down in the cold mist to get away from the mosquitoes. With greater contact with the outside world, malaria is now making its appearance on Rennell for the first time. Walking was hard on the lads' bare feet, for the coral was weathered to jagged and fairly sharp edges. Caverns appeared in the ground here and there—chimneys going down into darkness which was fingered by white stalactites. For long stretches of limestone exposures there was no soil visible anywhere, it having been washed into the cavern deeps by rain. It was a great relief in the falling darkness on the second day when we found ourselves on the edge of the scarp overlooking Kanggava Bay, and the lighted ships lying at anchor.

To investigate the eastern half of Rennell we landed several miles east of Kanggava Bay and climbed the steep rim (about 360 feet), and descended the hard white limestone into the basin towards the shore of the remarkable fresh-water Lake Te-Nggano. Extensive pockets of reddish-chocolate soil were noted in flat expanses between the limestone outcrops. From the sombre, swampy village of Niupani we were paddled for two hours on outrigged canoes, basking the while in the late afternoon sun, past islets of pinnacle limestone with hollowed-out solution caverns just above lake level; and occasionally bumping on submerged reefs which marked where similar islets had been completely dissolved away to water level. All around as far as the eye could see was the level-topped rim of the ancient atoll, everywhere covered with dense vegetation. Close to the shores of the lake it was noticeable that the shallow lake bottom was almost flat and composed of a soft white deposit into which the outrigger's pole could be pushed for several inches. Here were living forms—here the calcium carbonate from the solution-eroded islets and shorelines was being redeposited. Away from the shore the lake was deep and blue, like the sea; and with many miles of it so open that it is rather dangerous when strong winds blow. Although the breeze was slight on this peaceful afternoon, water was being shipped over the gunwales occasionally.

At sunset our long line of outrigger canoes reached Hutuna village, and pulled alongside the stone jetty whose green lawn surface extended back to embrace the foreshores and the entire rounded hill to the centre of this well laid out village. The light-skinned Polynesians led by their jet-black missionary and his family greeted us with the National Anthem and a short happy speech.

Residual hills stand within this old atoll basin, rising hundreds of feet above the surrounding country. These have been mentioned by Bradley. It is my opinion that they were once connected with the atoll rim before the tidal passages closed. Rennell is no older than Pleistocene. We have not so far sounded the depth of the lagoon and we were unable to confirm or belie the statement by earlier visitors that Lake Nggano is at an elevation of 75 feet above sea level, owing to a misfortune to our large barometer. Torben Wolff and Bradley travelled further afield on the lake and have written at length on the features: the 'Natural History of Rennell' is now being published in Copenhagen, incorporating the work of Torben Wolff and Bradley, and with a note on the geology by myself.

The important feature about Rennell is the apparently level rim—except in Kanggava Bay where sea erosion has apparently sapped into the original coastline so that the cliff tops are irregular. This is in any case the oldest part of Rennell. The Lavanggu Hill above Kanggava Bay is the highest part of the island and apparently the first part to rise above the waves in the vertical pulsating emergent movements since Pleistocene times. For a proper understanding of how such a great atoll can be built up, a study of the present-day development of the Indispensable Reefs 70 miles to the south would be of considerable value. I hope one day to be able to visit them.

Bellona Island.—Also Pleistocene in age, Bellona is 2 miles wide and 6 miles long in prevailing wind direction ESE.–WNW., the high inner rim being 260 feet

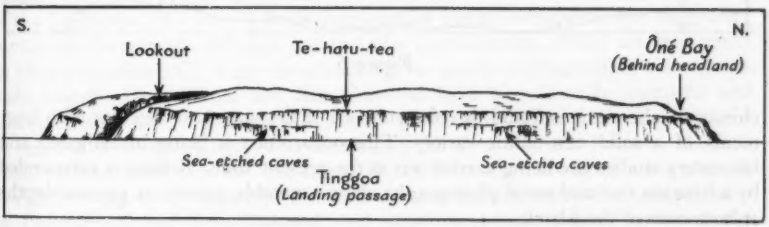


Fig. 5. Profile of Bellona Island from the east

above sea level, with lower outer level at 135 feet, and another at about 100 feet—where the old sea level mark is deeply etched into the almost vertical white limestone cliffs (see Figs. 5 and 6). In landing one needs to find a lee shore with a passage through the reef if there is any sea running. In calm weather one can land on the raised reef edge and wade through the lagoon to the foot of the jagged cliffs which can then be climbed, usually through a cleft. There are many well-used tracks into the valley, and walking becomes progressively easier as the limestone rim is left behind. There are no creeks, swamps or sinkholes, and no erosion of soil, although extensive soil deposits are—in the inner raised valley—dark chocolate, concolourous, humic soil country. Outcrops of limestone occur at places along the central track. The fertile surface soil is naturally porous, so that even before it has stopped raining the running surface water has for the most part been absorbed. It is less clayey than Rennell. The interior of the island is thus quite waterless; the people drink the water of growing coconuts, but have to climb the rim down to the sea in order to wash or bathe. This is no hardship as it involves only about twenty minutes' walk from any village. Occasional small caverns hold limited fresh water

below, at, or just above, sea level. Shafts excavated in the centre of the island down to sea level have not so far encountered water.

It is interesting to note the occurrence of phosphate deposits at the east and west of the island, on both ends of a one-time central lagoon. The phosphate is incoherent oolitic material called *malanga* by the people, and, at a few feet, in the

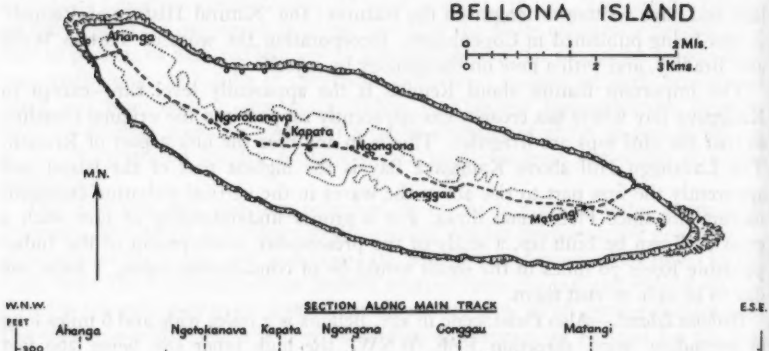


Figure 6

chimneys wherein it is found, is coherent rock of the same sort together with fragments of a solid non-oolitic variety. This occurrence is being investigated and laboratory studies are being carried out at the present time. Bellona is surrounded by a fringing reef and aerial photographs show a notable growth at greater depths at both ends of the island.

The Shortland Islands in the extreme west.—The great island of Bougainville (see Fig. 7), whose spectacular volcanoes rise 10,000–14,000 feet, is not included in the

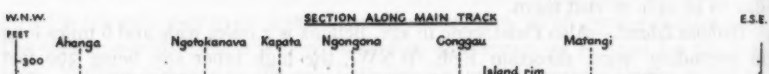


Fig. 7. Profile of islands of the Shortlands Group, looking west to the mountains of Bougainville (from Munia Island)

Protectorate, of which the boundary lies immediately to the south. The Shortlands Group consists of a large number of small coral and volcanic islets with three main islands, none very high above the sea. The main island of Shortland is 10 miles by 14 miles and no greater than 650 feet high. It presents a low rounded profile seen from the sea. The igneous core exposed in the north-west corner shows no emergence whatever, but the late Tertiary (?) calcareous mudstone (which constitutes the bulk of the island elsewhere) has been rising slowly since first laid down. Three

successive lines of one-time barrier reefs run from west to east across the centre of the island and veer northwards. The air photograph facing p. 314 shows the form of a fringing reef through the clear waters of the sea (after a period of no rain).[1] The southern coast is obviously an emerged reef with lower lying land—an old lagoonal depression—behind. The interior of the island is for the most part drained by subterranean streams. Fragments of pottery indicate many village sites long ago; but the population is now less than 500. Poperang island off the south-east corner has two springs—one of plentiful pure water, another of sulphurous cold water, both of which are believed to be juvenile in origin.

Twenty-odd miles southwards is the island of Mono or Treasury, 9 miles by 6 miles in size, and rising to 150 feet—showing a rounded flat-topped profile of decomposed mudstone, surrounded by extensive areas of recent limestone, with cliffs rising vertically from the sea about 60 feet. Landing places are few, but Blanche Harbour is well protected on the south by the emerged gently sloping coral island Stirling, which was once a barrier reef.

Choiseul and New Georgia.—The large islands of Choiseul and the New Georgia Group are largely unexplored, and will not be dealt with at present: within two years we hope to be able to give some information on these areas.

The Central Solomons.—The main islands (see Figs. 1 and 8) are 90 to 120 miles long, and 25 miles or so in width, most of them rising to about 4000 feet, but Guadalcanal to twice this height, 8005 feet. They are mostly covered by dense jungle. We will first deal briefly with the influences responsible for the sculpturing of the landscape. We have a limited amount of bathymetric data, but no gravity survey has been made although one is under consideration. What we have gives us clear indication of a linear trench along the southern (Australian) side of the main islands: Guadalcanal and San Cristoval have been heavily fractured and block-faulted on an enormous scale, some of the great shear zones being about 10 miles and more in length, and controlling the river courses. Between Guadalcanal–Florida–Ysabel on the one hand, and Malaita on the other, is a structural trough running north-westerly. Miocene sediments have emerged above sea level on Guadalcanal and San Cristoval, and show remarkable folded forms on the islands on the Pacific side—sub-parallel, first-order, easterly folds make roughly equal angles on both sides of the nor'westerly trough. These first-order folds provide the rounded hills which are distinctive features of the Malaita landscape: where there has been erosion in the centre of the closed anticlinal crests, the river systems show a distinctive dendritic pattern in the underlying Eocene (?) igneous rocks. In the overlying Miocene limestones and mudstones the river systems run largely parallel to the strike of the country. It is possible to map the geology from aerial photographs by recognition of these two quite distinctive river patterns. The highest part of Malaita is about 4000 feet. Since the formation of the easterly folds—the anticlines and synclines on Malaita—forces have been at work bending them, and their axes plunge to both sides of the island. Rivers that once began near the east coast and flowed to the west coast have been pirated—and now flow to the east instead. Puzzling deposits of heavy ilmenite gravels, far from their source

[1] The brown-coloured growing edge of the reef can be seen with a lighter line of debris below it on the outer slopes, which fall away at about 45 degrees to the deep water: the radial erosion channels on the seaward slope are clearly visible. Surf breaks on the reef edge, and the current sweeps shoreward across the sandy bottom of the shallow lagoon to the channel on the top right which is sapping its way into the lagoon. Will this one day turn the fringing reef into a barrier reef? At the top left can be seen the white coral-sand beach fringed by coconuts and backed by jungle.

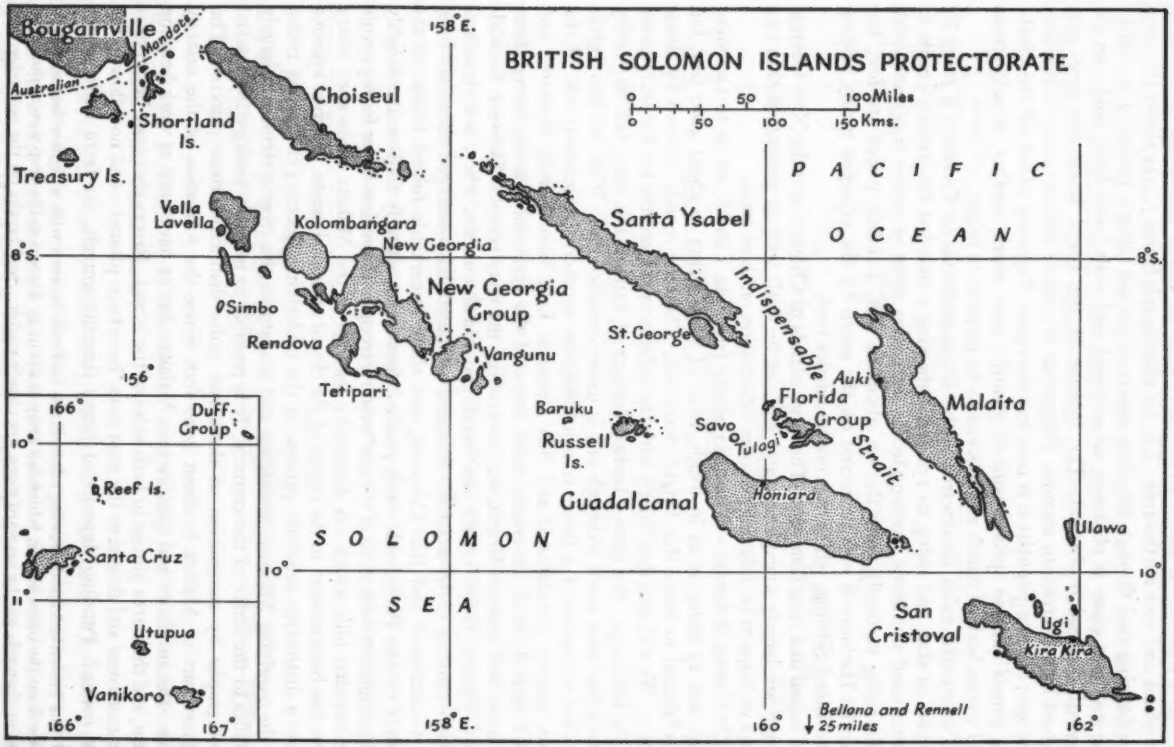


Fig. 8. The Central Solomons

and lying on the hill tops, or as disconnected pockets in country near river headwaters, can only be explained by this process.

To the south and on the other side of the trough, San Cristoval's physiography shows evidence of a northerly tilt with longitudinal twisting. All major rivers flow north-easterly for the full width of the island, starting for the most part within a mile of the south coast. But in the western end the emerged plateau is about 500 feet high and the rivers show meandering courses; further to the east of the western hammer-end of the island, and near to the south coast, are great raised swamps drained by north-easterly-flowing rivers; further east again the streams

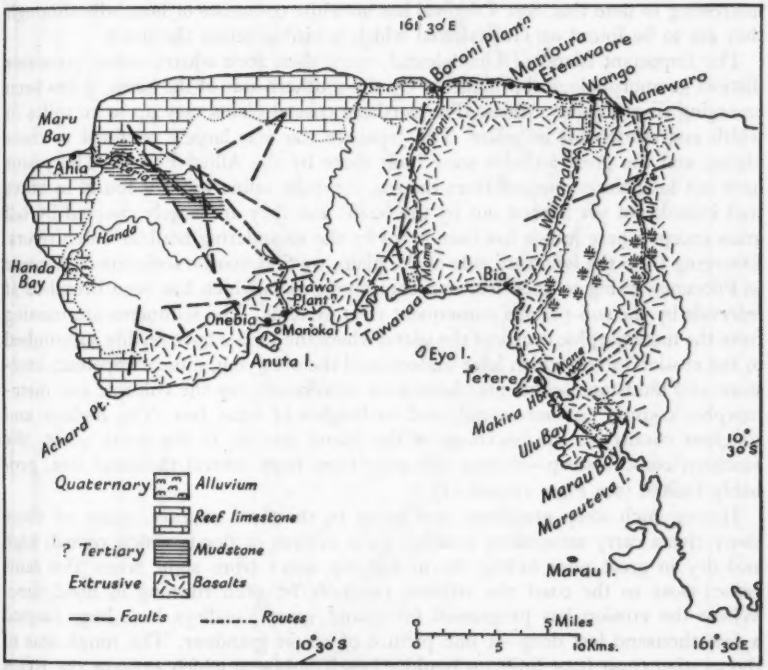


Fig. 9. Western San Cristoval

become increasingly entrenched and hazardous in the extreme (see Fig. 9). Most of the island is basalt, both massive and in pillow form; where the rivers flow through underlying coarse gabbro rock they are mostly impassable. The fairly even skyline and the general north-easterly tilt, with rivers in deep gorges, is typical of San Cristoval. Ridge crests are very irregular because of erosion on both sides of the razor-backs. A native foot-track follows the northern coastline for almost the full length of the island, but the south coastline is steep and difficult to negotiate on foot: it takes almost as many days to travel on foot as can be done in as many hours by canoe. Consequently canoes are used by the people; dugouts usually with outriggers, and with coconut palm fronds held vertically to catch the labour-saving force of the trade winds. San Cristoval is a land of earthquakes and

this affects the population distribution. As no great disasters have occurred since 1931, the population has been collecting again on the shores of the south coast; but the islanders do their gardening in the fertile and fairly mature alluvial valleys up to several miles inland. At one place in the centre of the south coast—at Marongu—I climbed a saddle at 800 feet and descended to the river head at 400 feet, only a mile from the coast. The Wairaha River fell only 400 feet in its 30 miles' travel to the north coast, and this is typical of the streams in the western and central portion of the island. In the east the gradient is very much more, and exploration is rather dangerous in times of rain. Although San Cristoval is only 35 miles east of Guadalcanal, there are astonishing differences between the fauna of the two islands: it is interesting to note that San Cristoval has no white cockatoos or hornbills although they are to be found on Guadalcanal which is visible across the strait.

The important island of Guadalcanal, more than 2000 square miles, possesses distinct geomorphological provinces. On the southern side of the basin, it has been emerging since Pliocene times. The northern coastal plains vary up to 10 miles in width and stretch for 40 miles. The Japanese war was largely confined to these plains, and the great airfields were built there by the Allied Forces. The plains have not long since emerged from the sea, for quite saline water is found in bores well inland, not yet flushed out by the fresh: and they are largely covered by tall grass except where jungle has been sown by the meandering boulder-laden rivers. Emerging from the landward side of the plain, we find marine sediments (Miocene to Pliocene), rising to 4000 feet in a continuous mass which has been breached at intervals by the sub-parallel consequent river systems. The sediments are missing from the metamorphic centre of the island where the schists have readily succumbed to the erosion forces, which have undermined the overlying, more competent, limestone and mudstone sediments. Remnants occasionally cap the volcanic and metamorphic country further inland, and to heights of 6500 feet. The highest and roughest country is the backbone of the island parallel to the south coast: the southern coast is steep—sloping abruptly down from several thousand feet, probably faulted (see Figs. 10 and 11).

Having such steep gradients, and being in shattered country, some of these short rivers carry astonishing boulder loads in time of flood, which remain high and dry in great piles hiding the underlying water from sight when the rains cease: close to the coast the streams can only be seen running in flood time. Where the erosion has progressed far inland, great V-valleys have been formed a few thousand feet deep—a fine picture of scenic grandeur. The rough seas of the weather coast have built up boulder beach ramparts which prevent the rivers from escaping immediately; some flow parallel to the shore for long distances before finding their way out at the base of a cliff. Such a boulder-beach rampart is illustrated in the photograph facing p. 314.

This country, up to 8000 feet high, only exists in the eastern two-thirds of the island. The eastern third is much lower and no higher than 3500 feet, and there are no emerged wide coastal plains. Instead, there is a coastline emerged by pulsating uplift—long periods of still-stand intervening during which the Miocene sediments were benched by the sea, and fringing reefs built outwards. A series of limestone terraces has resulted, grass-outlined against the sombre jungle background, tilted slightly northwards and rising one behind the other up to the flat-topped summit of Mount Austen at 1650 feet—this is the backdrop to Honiara township, and this is where the Japanese made their last stand.

The photograph facing p. 315 is an early morning aerial view of the emerged

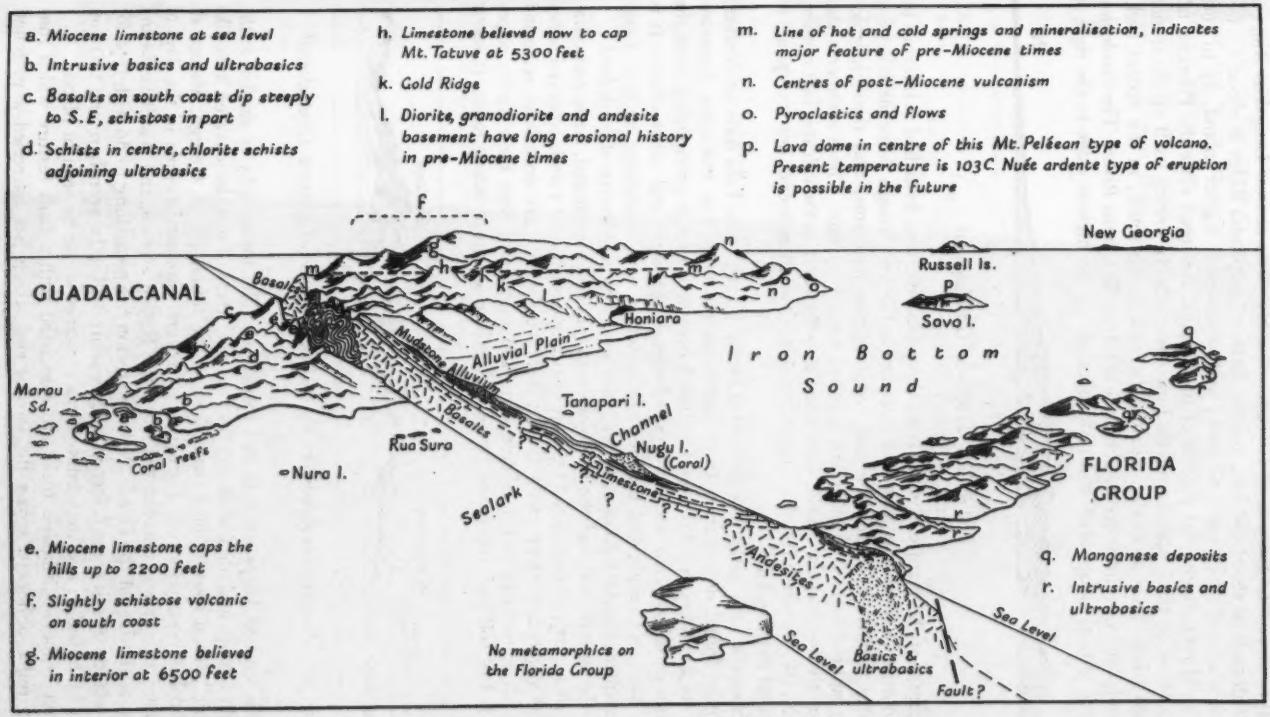

a. Miocene limestone at sea level
b. Intrusive basics and ultrabasics
c. Basalts on south coast dip steeply to S.E, schistose in part
d. Schists in centre, chlorite schists adjoining ultrabasics
e. Miocene limestone caps the hills up to 2200 feet
f. Slightly schistose volcanic on south coast
g. Miocene limestone believed in interior at 6500 feet
h. Limestone believed now to cap Mt. Tatuve at 5300 feet
k. Gold Ridge
l. Diorite, granodiorite and andesite basement have long erosional history in pre-Miocene times
m. Line of hot and cold springs and mineralisation, indicates major Feature of pre-Miocene times
n. Centres of post-Miocene vulcanism
o. Pyroclastics and flows
p. Lava dome in centre of this Mt. Peléean type of volcano. Present temperature is 103C. Nuée ardente type of eruption is possible in the future
q. Manganese deposits
r. Intrusive basics and ultrabasics
New Georgia
Russell Is.
Savo I.
GUADALCANAL
Basalts
Honiara
Mudstone Alluvium
Alluvial Plain
Iron Bottom Sound
Marau Sd.
Tanapari I.
Channel
Nugu I. (Coral)
Rua Sura
Coral reefs
Nuro I.
Basalts
Limestone
Sealark
FLORIDA GROUP
Andesites
Sea Level
Sea Level
No metamorphics on the Florida Group
Basics & ultrabasics
Fault?

Fig. 10. Bird's-eye view sketch of Guadalcanal and Florida Group

coralline limestone terraces of Honiara township. The nearest Lengakiki Ridge is at an altitude of about 160 feet, and the farther Lengikama Ridge at about 250 feet above sea level: they are flat-topped and successively higher inland, up to 1650 feet at Mount Austen, off the left of the picture. Emerged since the Pliocene, tall grass grows on the limestone ridges: jungle is gradually sowing itself up the erosion gullies where there is more moisture. Beyond to the south, in the distant background, can be seen the great valley of the Lunga-Betekama River. The Geological Survey offices, laboratories and residences are on the highest ridge to the right of

Fig. 11. Profile of Gaudalcanal

the centre of the picture. Inland from the coastal terraces, breached at intervals by the northerly-flowing consequent streams, is the very rough Miocene limestone country capped by mudstone and conglomerate remnants, and through which topographic "highs" of basement igneous rocks protrude. These sediments also dip gently northwards. In the west, parallel to the coast, is the volcanic belt running in a NNW. direction (see Fig. 12); active since the Pleistocene, hot springs are to be found in these hills.

Waterfalls such as the one illustrated facing p. 315 (near Fafo'ikafo on Malaita) are to be found downstream from limestone country. The travertine limestone with its level-terraced form and rounded convex slopes is precipitated from the calcium-carbonate-rich water by the change in pressure and other effects. It is quite hard and rough, and the face can be scaled with confidence on foot. Large eels frequent the deep pools so formed and are a welcome source of fresh food.

At the eastern end and the south-western end of Guadalcanal, basic and ultrabasic rocks may be recognized by their distinctive form, and a drab-coloured rather regular vegetation cover. Seen from a distance the hills are on a large scale and rounded, sometimes with landslide scars and sometimes with their higher slopes denuded of soil and vegetation by recent erosive action of heavy rains. It seems

Fig. 12. Looking north-west to the volcanic ranges of western Gaudalcanal

that the erosion keeps up with soil formation. The topography is similar in the Florida Group, and on Ysabel and St. George. Areas of boulder-covered hills (like "gibber" desert country of Australia) are to be found on St. George, whence all the soil has been removed. Populated by several thousand people in the days of the Spaniards, it was uninhabited when the British arrived, and is still *tambu* and known as the Isle of the Dead. Perhaps erosion has something to do with this, for small islands of soil some 6 feet in thickness are still to be seen here and there on the rocky hillsides: and man-built cairns of stones are to be seen in places.

Santa Ysabel's ultrabasic rocks are associated with a fault feature which runs for 50 miles obliquely across the island, and which has exercised a profound

influence on the geomorphology of Santa Ysabel.[1] On the southern side of the feature the older basement is exposed, and on the northern side, the younger overlying pillow lavas. The last earth movements have raised the younger pillow lava block on the Pacific side relative to the southern block showing the older material. There is little doubt—according to Stanton's investigations—that the

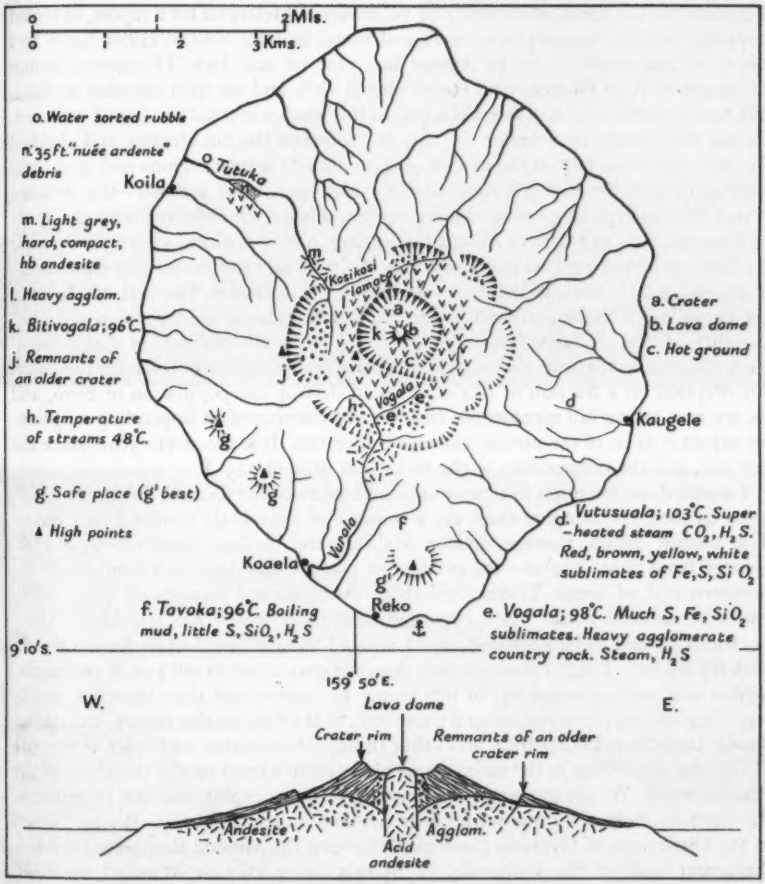


Fig. 13. Savo Volcano

earlier relative direction of displacement has been reversed, probably in sub-recent times, for the older basement is blanketed by Quaternary alluvial fans from the rejuvenated rivers on the north side of the thrust, where there is quite high relief. Stanton is at present writing on this subject, and I must not steal his thunder.

There is one very small island I would like to mention as an example of what the

[1] This feature was discovered by Dr. R. L. Stanton in 1956 and described in 'Notes to accompany a first geological map of Santa Ysabel,' shortly to be published.

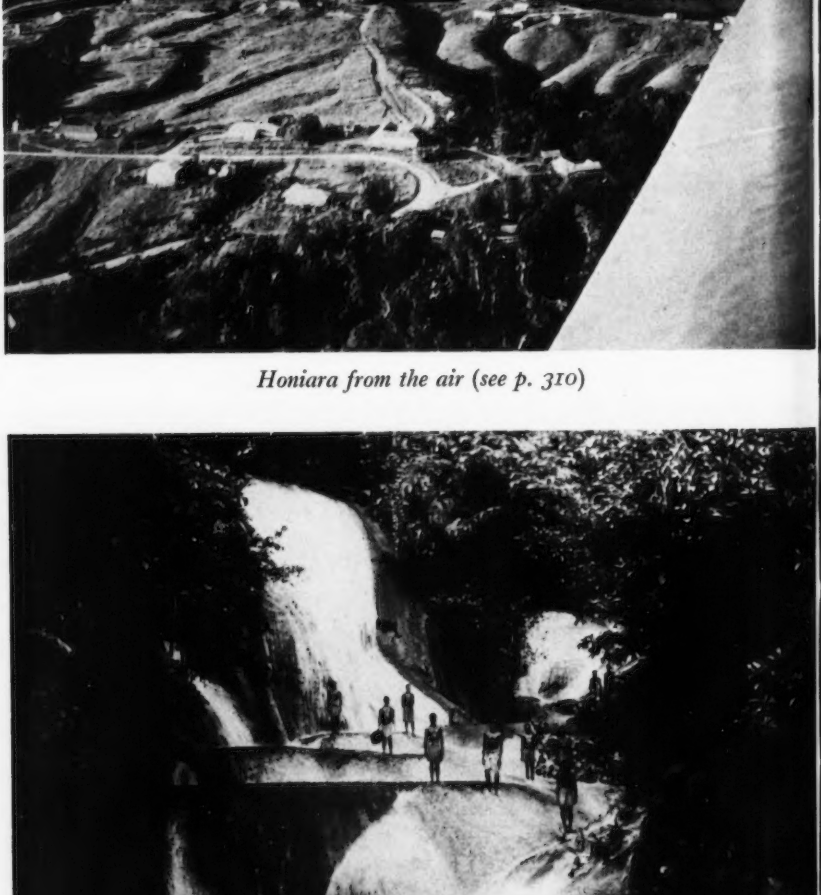
recognition of a feature led to. It is Savo Volcano about 20 miles north-west of Honiara, 10 miles north of the north-western extremity of Guadalcanal (see Fig. 13). Constantly on my horizon, and passing it regularly on my voyages, I never bothered to visit it, and regarded it as a volcano in the last stages of quiescence. It was visited by two geologists in 1950 but no aerial photos or maps were then available to show the set-up. Dr. Norman Fisher, Chief Geologist of the Bureau of Mineral Resources at Canberra, while studying volcanoes of Melanesia for a report, obtained copies of aerial photographs of Savo and noted that the central crater has a lava dome in the centre of it. In August last year he and Jack Thompson, Senior Geologist of New Guinea, paid me an official visit, and we went together to Savo. We found that the fresh-water wells dug in the beaches around the island were hot, as was the ground even under the sea. We followed the hot streams and climbed the steaming waterfalls in the gorges, and examined thermal regions and confirmed suspicions that the last eruptions of Savo had been *nuées ardentes*—the dreaded Mont Peléean type of glowing cloud eruption. Fisher was involved with the study of the great 1951 eruption of Mount Lamington in New Guinea, where 3000 people died in a radius of 7 miles, and great trees of the forest snapped off like matchsticks at ground level: 1 inch of the debris was enough to obliterate life, with the force of the explosion of the superheated gases carrying fragments in suspension at a temperature of 800° F. approximately. On Savo we found evidence of eruptions of such magnitude that the glowing cloud debris was 30 odd feet thick on the coast. An eruption on a fraction of this scale could destroy the population of Savo, and we are now taking full measures to ensure early warning of an impending eruption: we expect it to be of the utmost violence if it comes. It is about 110 years since the last one, and the temperature of the rocks is at present 215° F.

I would draw attention to a most unusual feature of the Central Solomons which gives us food for thought: there are a number of apparently dismembered rivers. The narrow Mboli Passage divides Malaita—the Gallego Channel divides St. George from Santa Ysabel—the north-west passage and Austria Sound divide the northern end of Santa Ysabel. Are these dismembered sections of pre-existing rivers of an earlier and more extensive land mass which has subsided? Many questions remain to be answered, and I regret I should have had to deal so briefly with my subject. I regret also that time does not permit me to tell you of our earthquakes and seismic seawaves; of our young hurricanes and their tides; of details regarding the people or the mineral prospects; of the fish, sharks, snakes, crocodiles, floods, landslides, falling trees and other things which rather add spice to the life of a geologist working in the mobile zone of the earth's crust on the threshold of the Pacific Ocean. We are pushing ahead rapidly with our exploration and mapping of the territory, helped by many friends in London and in Australia. We owe much to the Directorate of Overseas Geological Surveys, the Mineral Resources Division, the senior staff of the University of Sydney—in particular Marshall, Stanton, Coleman, Rickwood—the Australian Bureau of Mineral Resources; and to visitors such as the *Galathea* scientists from Denmark, Birket-Smith and Torben Wolff; the Bradleys, Eric Brown, Galbraith and others whose work are bricks to the edifice of knowledge. And lastly I would mention again the Royal Navy, whose trained observers were for so long our main source of knowledge of the islands. We learn with the greatest pleasure that H.M.S. *Cook* is now on the way to the Pacific, and will be spending some years there with us, carrying on the good work begun so long ago by her predecessors of the nineteenth century.

Fringing reef, seen from the air (see p. 307)

Boulder beach rampart (see p. 310)

Honiara from the air (see p. 310)



Waterfall, Malaita Island (see p. 312)

DISCUSSION

Afternoon Meeting, 25 March 1957

Before the paper the CHAIRMAN (Professor J. A. STEERS) said: We are fortunate to have with us Mr. J. C. Grover, who is directing the Geological Survey in the British Solomon Islands. Mr. Grover has spent some seven years in the islands and knows most of them intimately, and as some of them are virtually unexplored Mr. Grover has had a virgin field upon which to work. He hopes to return there in about a year's time.

Mr. Grover then read his paper

Dr. F. DIXEY (Colonial Geological Survey): I should like to congratulate Mr. Grover on his most interesting lecture, and also for the beautiful coloured slides he has shown. We are fortunate to have heard this lecture this afternoon because the information he has given us is not ordinarily available, and is based very largely on his personal activity and experience during the past six or seven years while he has been in charge of geological work in the Solomon Islands. Mr. Grover's work in the Islands has been characterized throughout by immense energy and great resourcefulness; he and his colleagues have been principally engaged in increasing our knowledge of the geology of the islands, and in this they have made great strides; previously very little of it was known, and there is still much to learn. Mr. Grover has also devoted much time to the investigation of mineral resources, and if economic deposits do exist there no one is more likely than he is to bring them to light. He has also been interested in a number of associated scientific problems, such as vulcanicity and deep-sea soundings. I should add that the cost of establishing the Geological Survey of the Solomon Islands has been very largely met from Colonial Development and Welfare Funds, as part of the post-war plan of extending the older overseas Geological Surveys and of initiating new ones where required.

Mr. Grover has touched on the subject of geomorphology, or the study of surface features, which can sometimes be of great assistance in filling in the gaps in later geological history. He has shown that certain channels between the islands may indicate the submergence of an early river system, and that flights of erosion platforms indicate later emergence at frequent intervals. It is often believed that the formation of these island arcs is of very recent date, or even still in process, and it would be of interest to know to what extent these erosion forms indicate general or local movement, or recent uplift along earlier axes of folding.

Mr. GORDON WHITTLE: I should like to ask two questions: firstly, has Mr. Grover been able to make a comparison between the regional geology of New Guinea and the Solomons and, in particular, to relate and to date the basement rocks in the Solomons, with those in the eastern half of New Guinea; secondly, has he observed any marked altitudinal zoning of the vegetation in the Solomons, as has been observed in other Far Eastern territories with considerable superficial relief.

Captain R. H. CONNELL, R.N.: I would like to say on behalf of myself and my colleagues, Captain Ritchie and Commander Pryor, how very interested we have been in the lecture, because we have recently sent a surveying ship, H.M.S. *Cook*, to the South Seas—for the first time since the beginning of the century. Our programme at the moment is somewhat fluid as so much depends on local requirements, but in general it is our intention to survey parts of Fiji and the Gilbert and Ellice islands this year. Next year we hope the ship will be doing the same type of work around the Solomon Islands; we may be able to assist Mr. Grover in some ways with his investigations into the underwater structure of the islands.

Mr. J. D. BRADLEY (British Museum, Natural History): Having spent a few months in the Solomons with the expedition from the British Museum in 1953–4 I appreciate the difficulties involved in getting about, and the extremely complicated geological formation, from coral atolls to volcanoes. I visited Rennell and Bellona Islands. Mr. Grover mentioned that the large inland Lake Te-Nggano was 70 feet

above sea level! Dr. Laird of New Zealand visited Rennell just before I did, and took with him an altimeter, and he found that the level of the lake was only 10 feet above sea level. The geologist who visited the island in 1927 made the estimation of 70 feet and subsequent visitors have followed this. We spent some weeks by the lake but we were unable to estimate the height. I was not aware of Dr. Laird's work at the time of my visit, and I accepted Mr. Grover's standard estimation of approximately 70 feet, and my estimation of the height of the hills round about were based on that. Rennell, from what I saw, was surrounded by a closed-in reef, which appeared to be a fringing reef, but in parts I believe it is a barrier reef. I am not sure whether or not Mr. Grover made any observations on that while he was on Rennell?

Mr. I. C. J. GALBRAITH (British Museum, Natural History): Dr. Cain and I were also on an expedition to the Solomons, and we know the physical difficulty of Mr. Grover's work, especially on the larger islands. We too climbed the Guadalcanal mountains, though not as high as Mr. Grover. We are interested in the Solomon Islands for the evolutionary peculiarities of their bird populations. Certain species are found on some islands but not on others, and many show marked variation from island to island, according to a clear geographical pattern. This phenomena of geographical variation is more strikingly shown in the Solomons than in any other small area. We are especially interested to see how far the origin and degree of isolation of the various island avifaunas can be explained in terms of geological history, and have learned much from this lecture and from Mr. Grover's published report.

Captain S. G. RITCHIE: In Mr. Grover's slides showing scenes on Rennell and Bellona we saw both Polynesians and Melanesians and I should like to know whether the latter were temporarily on Rennell or is there a Melanesian colony there? Mr. Grover said that the Polynesians on Rennell came from Uvea in Central Polynesia. I would like to know why he said that, and where the theory arose.

Mr. J. C. GROVER: As to Captain Ritchie's question, the population of Rennell is Polynesian; the Melanesians there were my geological survey personnel, but there is on Rennell one Melanesian family who are absolutely jet black—as they usually are in the western Solomons. Where the Polynesians come from is stated time and time again in their legends—from Uvea. There are two Uvea islands in the Pacific, one is entirely coral, the other partly volcanic in origin. I have seen fragments of the stones smashed up by the missionaries and they can only have come from the volcanic island of French Uvea in mid-Pacific. I am personally convinced by the story that these stones were brought to the islands about 450 years ago by Kaitu'u the leader of those who conquered and killed the Melanesians who then lived there.

To Mr. Bradley I am grateful for his mention of the heights of Lake Te-Nggano. Stanley (1929) describes the reefs as barrier reefs, because on the seaward edges there is a barrier based on the lagoon floor, and built up by the growing coral to 3 feet or higher. In part it is a barrier reef with the deeper lagoon behind and in part a fringing reef with a higher part on the edge of the reef where the growing coral is. All these lagoons seem to go partly into solution as a result of the current sweeping across them.

To Mr. Whittle I would like to reply that in time we hope to correlate Solomons stratigraphy with New Guinea's. Dr. Irene Crespin of the Australian Bureau of Mineral Resources and others have been identifying our fossil assemblages. Yes, there is definitely distinctive vegetation. Above 3500 feet, on the slopes of Popomanisiu on Guadalcanal, the tree roots become covered with green moss; above 6000 feet the green moss hangs down in stalactites and conceals everything; it is very uncomfortable to get through. At 8000 feet the trees become smaller and only reach up to one's chest. They are gnarled and flattened by the severely cold winds which come up to 8000 feet from the south coast.

Mr. G. WHITTLE: In North Borneo the vegetation altitude line comes down to about half what it is further west in the interior, which is probably due to cold winds coming in.

Mr. J. C. GROVER: It would seem so. It is very cold in this high country and the tracks are cut in the form of tunnels through the green vegetation; no sunlight penetrates and one walks knee-deep in moss; of fauna, there are owls, great rats and oppossum. There are few leeches on Guadalcanal, but since I saw Mr. Whittle last I have observed many leeches on Malaita, and on Rennell.

I thank Dr. Dixey for his kind remarks, and I would like to add that there is no regional correlation as regards the emergence of these islands. The more I know about them the more difficult I find it to correlate them with the largely accepted theories of island arc geology, but I feel we have both island arc geology and perhaps some continental stuff. The outer islands of the Solomons are folded gently, but San Cristoval and Guadalcanal in particular—I have not mentioned this in the lecture—are severely fractured. There is a vast fishnet pattern of fractures intersected by great shears, some of them 10 and 20 miles in length. I believe there are three blocks on Guadalcanal: the eastern block, which has been elevated and the western block only half the height of the central block. I have no doubt that if we treat the region as a whole—and one day we may be able to do so—we will find there has been differential elevation in blocks from east to west in the Solomons.

The CHAIRMAN: I hope Mr. Grover will come down to Cambridge so that I can talk to him at length about many of the points he has raised. I have many points I should like to put to him as to the formation of some of the smaller coral islands he showed in his aerial photographs; whether, for example, they resemble those on the Australian coast to some extent, in having a great deal of mangrove bordering them or whether the vegetation I noted in the slides were entirely land vegetation.

SHAR BAZHÊR AND THE BASIN OF THE QALACHUWALAN

C. J. EDMONDS

THE *qaza* (district) of Shar Bazhêr is that part of the *liwa* (province) of Sulaimani in 'Iraqi Kurdistan which lies to the north of Sulaimani town between Azmir, one of the parallel NW.–SE. ridges of the Zagros system,[1] and the Persian frontier It is approached from Sulaimani by three principal passes: Qayawan to the north, Azmir to the north-east, and Goyzha to the east. Of the seventeen British travellers who visited the *liwa* of Sulaimani before August 1914, and whose narratives I have traced, six out of the first seven crossed Shar Bazhêr: Sir Robert Ker Porter (1818)[2]; C. J. Rich, the Hon. East India Company's Resident at Baghdad (1820)[3]; A. N. Groves, Plymouth Brother Missionary (1829)[4]; Captain R. Mignan, Bombay Army (1830)[5]; James Baillie Fraser (1834)[6]; and Lieutenant-Colonel J. Shiel, later H.M. Minister at Tehran (1836). Of these Groves's diary has very little to say about geography, and Shiel (*Journal of the R.G.S.*, **8**, 1838) merely mentions, tantalizingly, that he travelled "in a NNE. direction by a well-known route" to Sardasht in Persia. The next and only other British visitor was Captain Bertram Dickson, British Vice-Consul at Van (about 1909), who, in an admirable generalized description of the highlands of Kurdistan (*Geogr. J.*, **35**, 1910), makes a brief reference to the district. For the blank period in the British list, a reason for which I am quite unable to suggest, we have some notes by Colonel E. J. Chirikov, the Russian delegate on the Turco–Persian Boundary Commission set up under the terms of the Treaty of Erzurum of 1847,[7] and the narratives of two European travellers, A. Clément (1856) and C. de Korab Brzezowski (1869). (See my article "A Third Note on Rock Monuments in Southern Kurdistan." *Geogr. J.*, **77**, 1930.) This and the neighbouring parts of 'Iraq have since been surveyed, and the maps on the $\frac{1}{2}$-inch scale printed by the 'Iraqi Survey Department in 1927 remain the basis for all subsequent compilations. But as far as I am aware the only description of, or record of travel in, this glorious country published since 1914 is the short paper by Dr. F. M. Halley referred to below. I trust therefore that the following notes, based on several visits which I paid to Shar Bazhêr between 1919 and 1929, will still be of interest.

The prospect that greeted my eyes when I reached the top of Azmir for the first time offered a striking contrast to the broad, orderly, synclinal valleys enclosed by the other parallel ranges to the south-west: a confusion of lofty ridges running in all directions, massive buttresses, bulging domes, neat rounded cones, wild crags and

[1] In Kurdistan the names of mountain ranges vary from sector to sector (often being derived from a prominent peak, a pass, a holy man's tomb, or a village at the foot), or sometimes according to the side on which the speaker lives or happens to be standing. In a general description one or two of the more familiar sectors must be selected to do duty for the whole.

[2] 'Travels in Georgia, Persia, Armenia, Ancient Babylonia, etc.' London, 1822.

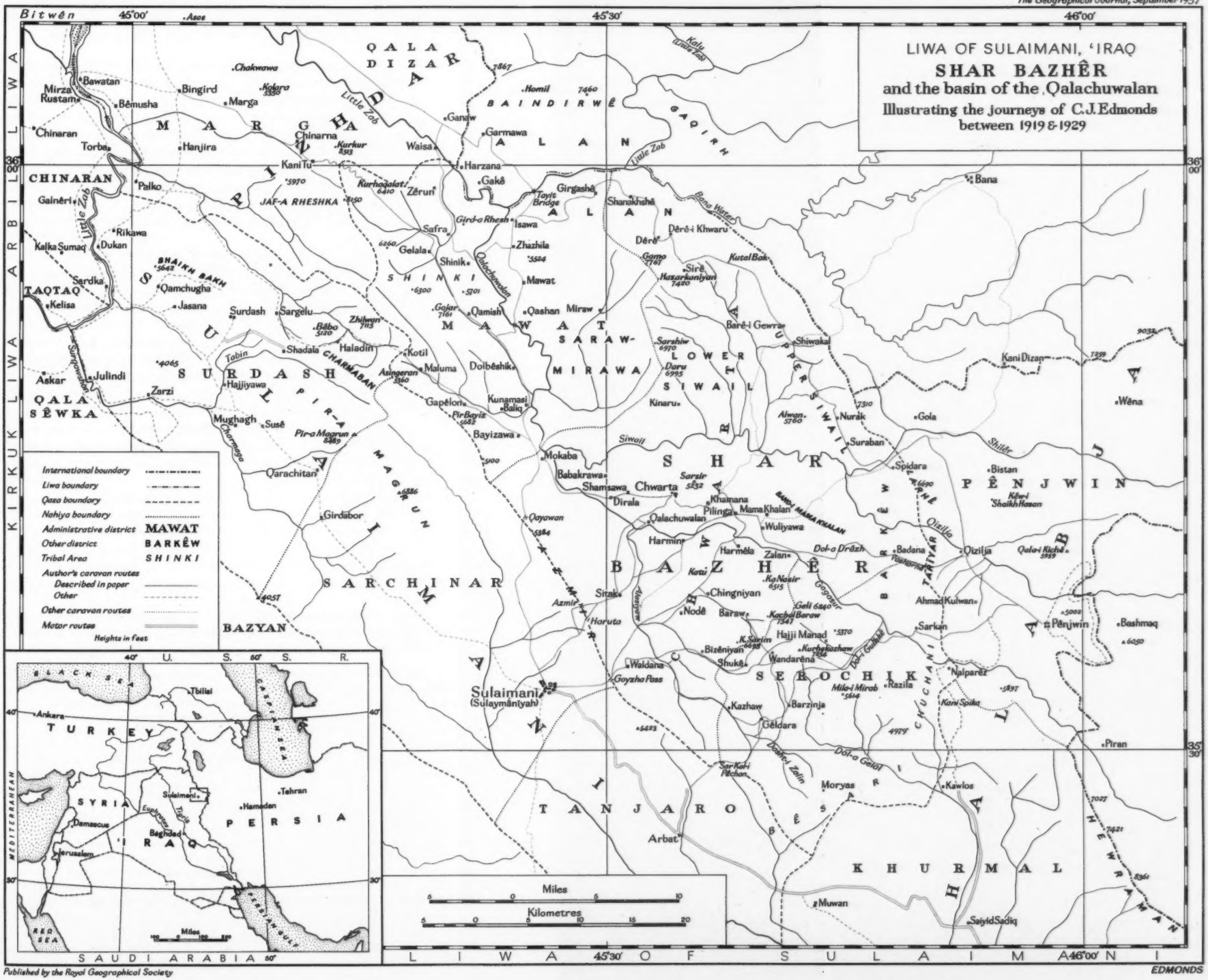
[3] 'Narrative of a Residence in Koordistan.' London, 1836.

[4] 'Memoirs of the late Anthony Morris Groves' (2nd ed.). London, 1857.

[5] 'A Winter Journey . . . into Koordistan.' London, 1839.

[6] 'Travels in Koordistan, Mesopotamia, etc.' London, 1840.

[7] 'Putevoyzhurnal, 1849–52 (Road Diary).' By a sad mischance the records and diaries of Colonel Fenwick Williams, the British Commissioner, were lost overboard in the Thames when he reached home.



Published by the Royal Geographical Society

soaring pinnacles, with no definite pattern distinguishable at first sight; only the long, even, 7000-foot crest of the main range, which here marks the frontier and is called Surkêw, could be seen coming down in the usual direction from the north-west. Immediately opposite the point where we were standing, 20 miles away to the north-east, the continuity of this range, and of the frontier, is interrupted for a distance of about 20 miles by three small rivers that break through from the east: the Shilêr, the Qizilja and the Gogasur, which rise respectively 30, 24 and 16 miles away on the other side. The sector of the chain between the Shilêr and the Qizilja is called Larhê, and the name between the Qizilja and the Gogasur is Tariyar; both lie entirely in 'Iraq; Tariyar is heavily wooded, flat-topped, and just about 6000 feet in altitude over most of its length.

The Shilêr and the Qizilja have no sooner broken through the barrier than they unite to form the Siwail, which continues to flow, with many twists and turns, in a general direction of due west. The Gogasur comes up from the east-south-east and acquires the name of Qalachuwalan from the ancient Baban capital on the right bank.[1] Finally, 8 miles further down stream, and about 18 miles in a straight line from the Shilêr–Qizilja confluence, the Qalachuwalan is joined by the Siwail and, the name Qalachuwalan prevailing, the combined waters turn suddenly northwards to carve their way by unbelievable cañons to the Little Zab, just where that river is itself zig-zagging through the main range. The northward turn of the Qalachuwalan is so unexpected, and the local system of nomenclature so misleading,[2] that it is hardly surprising that for many years all maps should have shown the river as continuing to flow north-west and reaching the Zab by way of the deep ravine of Palko 60 miles downstream and 25 miles due west of the correct position. Nevertheless the persistence of the error was curious since, in this particular area, Ker Porter, Rich, Fraser, Brzezowski and Chirikov[3] had all described the course correctly. It was not put right until October 1921 when Dr. F. M. Halley, the Civil Surgeon at Sulaimani, rediscovered the true confluence. (See the note in *Geogr. J.*, **59** (1922) 146, and Halley's own article in *Geogr. J.*, **86** (1935) 158–64.)

West of the Qalachuwalan the mountain structure resumes the normal direction as a fluted mass of more or less parallel ridges and narrow troughs rising to the

[1] The Baban realm survived until 1847 as a quasi-autonomous principality under Ottoman suzerainty. Ibrahim Pasha Baban (reg. 1783–1803) transferred the capital from Qalachuwalan across Azmir to the village of Malkandi, where he built a new town, Sulaimani. Rich gives a lively account of his sojourn at the Baban court in 1820.

[2] The nomenclature of rivers presents much the same difficulties as that of mountains. Certain names like Zê (Zab) and Sirwan apply to the river only and are used to describe it over much of its length. But far more frequently different reaches are known as the water (*aw*) or stream (*cham*, *chom*) of such and such a village, district, ford, or even person.

[3] Although Chirikov himself had got it right the compilation of the surveys carried out by the British and Russian delegations was interrupted by the Crimean War (1854–56) and the Anglo-Persian War (1856–57). It was completed in 1865; but when the British and Russian sets were compared, it would seem for the first time, so many discrepancies were found that the surveyors were obliged to sit down again to eliminate them. Four more years passed before the new map, styled 'Carte Identique,' was ready for communication to the parties. The survey was of a belt of country within which the frontier to be determined would lie. In this sector the map shows an unbroken watershed swinging round from Kurkur on the west and passing about 9 miles south of the position of the true Qalachuwalan-Zab confluence to the Daru-Gamo rib, with the Siwail passing south of it. The Commission of 1914 prepared a series of 'Cartes Supplémentaires' for parts of the frontier where they considered the old map inadequate, but they did not make a new survey at this particular point. I have to thank the Librarian of the Foreign Office for permission to consult these maps.

central spine of Gojar-Kurkur, which emerges to the north-west as the clearly defined hog's back of Asos dividing the broad plains of Marga and Bitwên on one side from that of Qala Diza on the other. Each of the troughs has its own internal watershed separating the slopes that drain eastwards to the Qalachuwalan or the Safra gully described later in this paper and those that fall westwards directly to the Zab itself. The *qaza* of Shar Bazhêr is enclosed: on the south-west by Azmir, on the west by the watershed just mentioned, on the north by the Zab and its affluent the Bana Water (where these rivers also mark the frontier), on the north-east by Surkêw, Larhê and Tariyar, and on the south-east by the line of low hills that bounds the northern edge of the Shahrizur plain; it is divided into the three *nahiyas* (sub-districts) of Mawat to the north-west, Chwarta in the middle, and Serochik to the south-east. The whole of the Qalachuwalan basin west of Larhê-Tariyar falls within these limits [1]; but the drainage of the southern half of Serochik collects in a long gully called Dol-a Gelal and breaks through the above-mentioned line of low hills to reach the Shahrizur plain near Kawlos, a well-known stage on the Halabja–Pênjwin road, and eventually the Sirwan (Diyala). The majority of the population of Shar Bazhêr consists of non-tribal peasants; but, as in most parts of Kurdistan, a village of any size generally has a resident squire in the person of the principal (or the most sophisticated) landlord, or a religious Shaikh, or a tribal Agha who may have established himself there by force. The squire is required by custom and by considerations of prestige to maintain a guest house where even the humblest traveller can claim entertainment and bedding. Where there is no squire the Mukhtar, or village headman, makes himself responsible for the entertainment of travellers in the mosque, there being no prejudice against the admission of persons not of the Muslim faith.

The *nahiya* of Mawat (pop. 11,300) lies astride the Qalachuwalan as it carves its way northwards to the Zab. Local geographers apply the name Alan to the districts on both banks of the Zab near the Qalachuwalan confluence, and to the 'Iraqi bank of the Bana Water, along the reaches where these two rivers mark the frontier. Another regional name frequently heard is Saraw-Mirawa, so named after the largest of nine villages in the south-east corner of the *nahiya*. Most of the villagers are non-tribal, but there is a small clan called Shinki with four or five villages on the left bank of the Qalachuwalan near its mouth. At the time of our occupation, however, the whole of the *nahiya* (except Saraw-Mirawa) was indisputably within the sphere of influence of the ruling family, surnamed Mirawdali, of the Nuruddini tribe, more commonly known as Pizhdar, whose real home was the Qala Diza district. Those travellers who crossed Mawat and described their routes in any detail are unanimous in their tributes to the majesty of the scenery. Mignan, at this point, becomes quite lyrical: "Without any exception I may safely aver that Kurdistan is the loveliest country I have ever beheld . . .; these passes are in truth the most sublime and solemn solitudes that can possibly exist and rouse the breast of man to meditations bordering on rapture."

That part of Chwarta (pop. 18,000) which lies north of the Siwail river was at one time a separate *nahiya* called sometimes Siwail and sometimes Shiwakal after the village from which the ruling family of the region took its title. The name Barkêw is used to describe the country immediately to the west of Larhê-Tariyar between the Shilêr to the north and the Gogasur to the south; it thus lies partly in Chwarta and partly in Serochik. Serochik (pop. 9400) is the stronghold of the most

[1] The country between Larhê-Tariyar and the frontier constitutes the *nahiya* of Pênjwin, which is subordinate to the *qaza* of Halabja.

influential family of Saiyids, descendants of the Prophet Muhammad, in Southern Kurdistan. The family takes its name from the considerable village of Barzinja situated in a fold of the southern spurs of Kurhakazhaw and 14 miles east of Sulaimani, and is said to have been founded in A.D. 1258 by a certain Saiyid Isa Nurbakhsh of Hamadan in Persia. According to the story he and his brother were returning from the pilgrimage to Mecca when they were told in identical dreams that somewhere on the onward road they would find a large black stone which they must carry with them until again bidden in identical dreams to halt and build a mosque. This duly happened at the present site of Barzinja and the black stone was inserted, in the manner of a commemorative foundation stone, in one of the walls. Barzinja has another title to fame for it was from here that the son of Saiyid Isa's old age, after a quarrel with his elder half-brothers, set out to found the mystical order known in Western Persia as Ali Ilahi and in 'Iraq as Kakai.[1] The best known contemporary member of the senior and orthodox branch of the family is Shaikh Mahmud, who between the wars proclaimed himself King of Kurdistan and was for many years a recurring nuisance to the mandatary administration of 'Iraq. In the southern half of Serochik water is on the whole scanty in summer and autumn in contrast to the rest of Shar Bazhêr. The south-east corner of the nahiya in and around the Dol-a Gelal, and part of Barkêw, are the home of a curious group of semi-nomadic clans called Nawdari (Within-the-Gap) or Ghawara (Outsiders).[2] They represent elements of the population of Shahrizur which were driven out by the coming of the great nomadic tribe of Jaf in the eighteenth century. The opprobrious name Ghawara, as well as popular stories that they avoid water and never wash, no doubt originated with the conquerors who expelled them.

My earlier visits to Shar Bazhêr were made in the summer of 1919, after the suppression of Shaikh Mahmud's first rebellion by "Fraser's Force," which I had accompanied as Political Officer. The task of getting the administrative machine working again kept me stuck closer to my desk than I liked, and I was obliged to see as much of the country as I could in three hurried week-end trips to Chwarta and Serochik, and always on some official errand. The first trip was made with the specific purpose of examining the desirability of transferring the seat of the *qaza* administration from the old Turkish headquarters at Sitak (which was so close to Sulaimani that officials were tempted to come to town on the slightest excuse) to some more central position north of the Gogasur. I crossed the range by the Azmir pass, the view from which I have already described. Descending through thick woods very different from the bare slopes of the Sulaimani side we reached Sitak in just three hours of leisurely riding from the start and, in accordance with the custom of the country, were received by the officials and leading inhabitants lined up on the outskirts. It was a pleasant village of some twenty houses situated among groves of poplar, plane and willow, and surrounded by extensive tobacco gardens and some fields of wheat and barley. We mounted before six the next morning and,

[1] The first European authors and travellers to report the presence in Western Persia of the Ali Ilahis seem to have been J. M. Kinneir in his 'Geographical Memoir of the Persian Empire' (1813) and George Keppel in his 'Personal Narrative of a Journey from England to India' (1817). The earliest detailed discussion of the order is that by Major, later Sir Henry, Rawlinson in his famous paper "Notes on a march from Zohab to Khuzistan" *Journal of the Royal Geographical Society*, 9 (1839) 26–116.

[2] The component clans are: Bêsari (7 villages, 60 families); Chuchani (4 villages, 50 families); Hoz-i Hasani (2 villages, 35 families); Parkhi (1 village, 30 families); and Qawilayi (100 families scattered after the famine of 1918).

dropping down to a broad watercourse called Alasiyaw about half a mile to the east, followed the bed northwards to its junction with the Gogasur, which we forded in 2 feet of water just above the confluence and below the ruins of Qalachuwalan. Another hour, first over gentle slopes deep in waving hay, and then up a steep and rocky path between hedges of blackberry bushes and climbing vines, brought us to Chwarta, the village which had been suggested as a good site for the new *qaza* headquarters, and later, after the transfer, gave its name to the central *nahiya*. We were met on the outskirts by the Mukhtar and conducted to the broad roof of a spacious mosque, where a line of villagers, hand on breast, bade us welcome. Fresh and tender walnuts and almonds, grapes scarcely ripe, bowls of fresh milk and of curds (*mast*) and basins of mixed curds and water (*mastaw*), with carved ladles of pear wood floating on the surface, were set before us, and when the samovar had boiled, sweet tea in little Persian glasses was handed round. The preliminary honours thus discharged, we went up on foot through the village to continue the discussion of the business in hand by a spring in the cool shade of two or three giant planes.

Chwarta is situated at an altitude of 4000 feet on the south-western slopes of a mountain called Sarsir and commands a superb view across the Gogasur valley to Azmir; it struck me as a most delightful place, nestling among almond and mulberry orchards in the shade of tall slim poplars, spreading walnuts and enormous planes. The Kurds discovered many centuries ago that villages built on a mountain side have the great advantage of being what they call *yek hewa*, "of single climate," and that they are less exposed to violent fluctuations of temperature than those built on the flat. For practical reasons also the place seemed to me very suitable for the *qaza* headquarters. It was reasonably central. Sarsir stood out in a well detached position overlooking the valleys of the Gogasur to the south and the Siwail to the north, so that the domed summit (5250 feet) offered an excellent point of vantage for visual signalling in every direction, a most important consideration at that time. There were easy tracks leading east, north and west, and I formed the opinion that there would be no great difficulty in finding a suitable alignment for a motor road from Sulaimani. Every Kurd is a born connoisseur of the digestive qualities of water, and, in the not entirely disinterested opinion of the minor officials from Sitak in our party, all these advantages were outweighed by the reputation of Chwarta spring water for being *giran*, heavy on the stomach. I returned to Sitak for the night by a track to the west of the other, and thence to Sulaimani by a rough and little used pass called Haruta about a mile south-east of Azmir.

The following week-end I made a similar hurried visit of exploration, this time over the Goyzha. After crossing the Alasiyaw 2 miles above Sitak the road forks, left to Harmin, Shiwakal and Bana, right to the important caravan stage of Wuliyawa; here the track forks again, left to Bana by the Kani Dizan pass over the frontier, and right to Pênjwin. The Harmin fork is marked by a curious spring called Sazinda, the Musician or Warbler, bubbling up in the middle of the highway. We took the Wuliyawa road and I was now able to enjoy several long canters over lovely going. We passed Nodê hidden in a deep watercourse on our right; and 2 miles further on turned aside for the night to Chingniyan, a well-built village, rich in vineyards and other cultivation, reputed for the excellence of its water, and owned by Shaikh Mahmud himself.

The next morning, a mile beyond Chingniyan, we passed through a narrow defile with the great massif of Kurhakazhaw on our right and on our left a curious hill shaped like a breaking wave called Katu; this stretch is known as Dol-a Tu

(Mulberry Dale) from a ravine, familiar to local topographers, running up eastwards into the massif. We halted for our midday meal at a charmingly situated and prosperous village appropriately named Harmêla, Little Pear Tree, whence we looked down over the sparkling waters of the Gogasur (here called Tankabuwar) to Wuliyawa. There was only about 1 foot of water at the Tankabuwar ford. Fishermen were busy close by with their nets. Immediately after crossing we left the caravan road and turned westwards up a steep slope and through a veritable forest of dwarf oak, until we reached a pleasant stretch of open country with pears and sumach growing wild in great profusion and vineyards on the surrounding slopes. Cattle were sheltering from the heat of the sun under the larger trees, and a line of poplars betrayed the presence of the small village of Pilinga close by. We had hardly dismounted before carpets had been spread in the shade by the village spring and cistern, to be followed, of course, by bowls of *mastaw* and glasses of tea. At half-past four, when the heat had abated, we mounted again, turned south-westwards over the hill and descended by a steep path back to the Gogasur, here flowing between high cliffs. We followed the bed westwards past several invitingly deep pools for about 2 miles before crossing to the south bank; from here a short ride across park-like country brought us to the Shiwakal caravan road and the village of Harmin, also named after its pear-orchards, where we spent the night.

My third and most interesting week-end trip (August 14–16) was made to Serochik with the object of showing the flag in this hot-bed of sedition and installing the new Mudir, Abdur Rahman Agha, a member of a prominent Sulaimani family, who for greater safety had been authorized to recruit his own escort and other subordinate staff. From the top of the Goyzha pass we turned east, away from the Wuliyawa road, down past the small village of Waldana to the Alasiyaw, 2 miles above the point where I had crossed it on my last excursion. We then followed this watercourse upstream in a south-easterly direction, crossing and recrossing it continually, until we reached the village of Kazhaw, which gives its name to the mountain. We now left the river bed for more open country and reached our destination, Gêldara, after dark in just five-and-a-half-hours' riding from Sulaimani. A horrible *rhesheba*[1] blew all night and covered us with all kinds of litter and filth as we tried to sleep. Gêldara was another well-built, prosperous village of forty to fifty houses situated on the inner slope of a horse-shoe hill with extensive tobacco gardens (where the picking of the new crop was just beginning) nearby, and fields for ordinary winter and summer crops out on the flat below. It had been the administrative centre of the Serochik *nahiya*, and there was a good government Serai, with offices, revenue barns, and accommodation for the Mudir's family. From Gêldara we rode out round the eastern arm of the horseshoe and then turned north in the direction of Kurhakazhaw, a gaunt, rugged peak soaring up into the blue sky 4000 feet in 4 miles.[2] In ten minutes under the hour, before I had any idea

[1] *Rhesheba*, the "black wind," blows in many parts of Kurdistan. In the summer it is hot and relaxing; in winter it is bitterly cold. In my experience the worst places are under the lee of a long ridge, on the south-west; the wind from the north-east comes over the crest with a bump and streams down the mountain side and some way across the valley before it dies away.

[2] In spite of many inquiries on this and other journeys I have found some difficulty in establishing the correct nomenclature of the Kurhakazhaw massif. The latest compilation (Xth Army, April 1942, 1 : 100,000) shows: (i) a central ridge running south-east to north-west with three peaks of 5614, 7254 and 7347 feet respectively, only the last having a name, "Geli"; (ii) a parallel ridge on the north-east side of the other with three peaks marked respectively 5370, 6240 and 6515 feet, the whole range being named "Kurikazao" and peak 6240 "Barda Kunti"; and (iii) an isolated peak on a south-western spur marked 6693 and

that we were so close, our path turned sharply and brought us suddenly up against the very edge of Barzinja, a large village of between 150 and 200 houses built up in nine or ten superimposed tiers in a fold of the great southern spur of Kurhakazhaw itself. It might have been a painting in sepia, the different shades of dull brown relieved only by a few bright dresses in the great crowds of men, women and children that thronged the housetops as we rode in.

We dismounted at the famous mosque. It is a large building as village mosques go, the wooden doors, the matting of the ceilings and the poplar rafters all black and shiny with smoke and age. The black stone of Shaikh Isa measures about 15 by 12 inches and is set in a wall of the corridor just by the door giving access to the prayer hall and is smooth and polished with much kissing. A large iron latch-ring is also claimed to be an exact copy of the corresponding ring at Mecca. I had no wish to receive hospitality from persons who might have been implicated in the late rebellion so, after a short halt, we pushed on to the two hamlets of Wandarêna and Baraw, perched high up on the flank of the mountain, before turning homewards down a long, winding, rocky watercourse to the vineyards, orchards, tobacco terraces and poplars of Bizêniyan. Leaving Abdur Rahman to return to his post at Gêldara I rode the next morning across country back to Waldana but, again for variety, took the Little Goyzha pass which is to Goyzha what Haruta is to Azmir.

My next visit to Shar Bazhêr was made in the summer of 1922 when I had occasion to ride from Qala Diza to Sulaimani. This took me into the magnificent highlands of Mawat through which the Qalachuwalan cuts its way after its northward turn and which made such an impression on the early British travellers; but since my route was precisely that taken by Halley just a year earlier I will not prolong this paper by describing it here. On the return journey I followed the same track in reverse for the first 25 miles and then, instead of crossing the Qalachuwalan at the Qashan bridge, turned north-west to the Shinki village of Qamish, where I was entertained by the Mirawdali squire, Amin Beg. The following morning we led the horses and mules by an exceedingly steep goat-track over the top of Kurkur, at about 8000 feet. My notes and photographs were lost in a tribal rising a few weeks later, but I remember fairly clearly a sort of crater at the summit, the inside looking like a sea of once-boiling mud that had congealed into the most fantastic shapes. The descent on the far side to the Mirawdali-occupied villages of Kani Tu (a lovely place where we all, men and animals, were glad to halt for the night) and Chinarna in the Marga *nahiya* was even steeper than the ascent, quite the steepest track, I think, that I have ever tackled in all my travels.

On my fifth visit to Shar Bazhêr, in the autumn of 1927, I was accompanied by Major G. Anderson, then the R.A.F. Special Service Officer at Sulaimani. We left Pênjwin after noon on October 17 and rode north-westwards across a flat open plain about 6 miles to the village of Qizilja, having the thickly wooded slopes of Tariyar on our left and the Qizilja river about half a mile away on our right; beyond

named Woshkasheo. It seems clear that the surveyors reversed the names of the two parallel ridges, and the weight of the evidence is as follows: peak 7254 of the first ridge is definitely Kurhakazhaw, but the name is also commonly used to denote the whole massif; peak 7347 (the highest) is most commonly called Kachal Baraw from the village of Baraw on its southern flank but sometimes just Kachali; peak 5614 is Mirab (or perhaps Pisht-i Chinara); in the other ridge peak 5370 is Pisht-i Hajji Mamand from the village below, peak 6240 is Geli and peak 6515 is Ka Nasir; isolated peak 6393 is Kalla-i Sarim; I suspect that Woshkasheo is *wushkeshiyw*, dry ravine, which might be the name of any ravine coming down from the heights given to the inquiring surveyor.

the river the plain seemed to be bounded by Qala-i Kichê (Maiden's Castle) and Kêw-i Shaikh Hasan, two well-separated conical hills rising steeply out of it, but in gentle outline, some 1500 to 2000 feet. On the road we passed a camp of Nawdaris of the Hoz-i Hasani section. The village of Qizilja, once the headquarters of the district of that name, is situated at the foot of the Pasharhê pass over Tariyar on the main caravan track from Sulaimani to Pênjwin, and near the mouth of the gorge where the Qizilja River breaks through between Larhê and Tariyar. This mouth is dominated by a remarkable pinnacle of rock, on the summit of which Rich recorded the ruins of an ancient castle and where the administration had recently built a police post. The Begzadas of the Jaf tribe have often told me that in the good old days this was a favourite camping ground of their ancestors, who were accustomed every year to build a dam just inside the gorge to form a lake. We were received by Hama Reshid Agha, head of the ruling family of Shiwakal, who had come from his village of Nurak to welcome us, and by a distant cousin, Hama Salih Agha, who owned Qizilja itself. After an excellent dinner we retired to our tents which had been pitched about three-quarters of a mile away, down by the river. Here out on the flat, at 4000 feet, the night was bitterly cold (the shade temperature at 6.15 a.m. was 34° F.), far colder than it would have been in an ordinary village on a mountain side at a higher altitude.

The shortest and easiest way from Qizilja to Siwail follows the river through the gorge, but we preferred a route up a northern extension of the plain with Larhê on our left and the Kêw-i Shaikh Hasan on our right. After about two hours we came in sight of the Shilêr below the village of Gola and swung westwards, following the main Bana–Wuliyawa caravan track high above the river for about 3 miles round the end of Larhê. After turning aside for lunch to Spidara (4300 feet) higher up the hill we dropped down to ford the river, here called Cham-a Reshid, where it breaks through between Larhê and Surkêw. From the track high up on the far side we got an excellent view of Shilêr-Qizilja confluence before turning north-westwards through Suraban to Nurak. Nurak was a picturesquely situated village amid walnut and mulberry groves, on the bare south-western slopes of Surkêw. The panorama was enclosed on the south-east by Larhê-Tariyar and on the west by a bastion standing out from Surkêw called Kêw-i Alwan, but there was a splendid view of the Qizilja valley where it bisects Barkêw and, on the south, to a long wooded ridge called Band-i Mama Khalan, over which loomed the peaks of Kurhakazhaw, Katu and Sarsir, with Azmir just visible in the distance; to the north-west, round the other side of Alwan, a conical hill in Mawat called Gamo, always an unmistakable landmark, was clearly visible. At 6.15 the next morning the shade temperature was 55° in contrast to the 34° at Qizilja, 750 feet lower. We had a pleasant march, following the contours of Surkêw through a line of enchanting well-watered villages set among walnut, mulberry and fig trees, with blackberry hedges bordering the paths, and surrounded by tobacco fields, to Barê-i Gewra where we were received by Hasan Agha of Shiwakal. Our march the next day continued in the same direction but over rather rougher ground. Two hours after mounting we halted on an eminence called Kutal Bak to enjoy a glorious view on to the end of Surkêw where the frontier line drops to the Bana Water, a long ridge called Gaqirh with the green of villages nestling on its slopes, the gorge where the Zab (here called Kalu) breaks through the main range of Zagros, then the grey cliffs of Baindirwê and Homil that enclose Persian Alan on the north. We spent the night at the delightful village of Dêrê-i Khwaru, under the shadow of Gamo, in 'Iraqi Alan, as the guests of the Mirawdali squire, Mustafa-i Usman Agha.

We were now within the sphere of Pizhdar domination. Our host's own following had been reinforced by arrivals from other villages, and it was with an indescribable feeling of exhilaration that I set out from Dêrê at seven the next morning, preceded by the once familiar ping-ping-ping-ping-ping-a-ping-a-ping-a-ping of a mounted kettle-drummer and surrounded by a jostling crowd of tribal horsemen, all armed to the teeth, extraordinarily well mounted, and dressed in the brightest colours. My attention was particularly attracted by Mamand-i Sa'id-i Usman Agha (who had arrived just as I was getting up in the morning in command of a contingent from Sirê near which we had passed the previous day), a clean-faced boy of fourteen or so wearing a pointed and tasselled skull-cap made of velvet in rainbow colours protruding from a silk turban of dark and light grey, a suit of bright blue with the voluminous peg-top trousers thrust into black top-boots, a broad waistband of red and yellow cotton print wound many times round his body, and two bandoliers, one over the waistband and a second slung over his shoulder; he was riding a powerful stallion and displayed remarkable horsemanship, galloping and wheeling up and down the most hair-raising slopes. Our path at times was winding and precipitous and at others took us across oak-grown, park-like country; but all morning we had ahead of us superb views to Persian Alan and the huge amphi-theatre of Gaqirh, Baindirwê and Homil. After passing through Shanakhshê and Girgashê we looked down from above Isawa on to the junction of the Qalachuwalan and the Zab, and then turned south to spend the night at Zhazhila.

Our next destination was Qala Diza. The usual route by the Tayit bridge over the Zab followed in earlier years by Halley and myself involved a trespass on Persian territory of 5 miles. To avoid this we decided to try the Shinki track, of which everybody had given us the most alarming accounts. From Zhazhila we rode down the hill westwards and forded the Qalachuwalan by the Buwar-i Zangzang at a break in the succession of gorges which it enters near Qashan. After crossing a col about 1000 feet above the level of the river we found ourselves in a deep, narrow gully called Shiw-i Safra (from the Shinki village of that name where we entered it), between mountains called Gird-a Rhesh on the east and Kurhaqalat on the west. For an hour and three-quarters we picked our way northwards, sometimes along the boulder-strewn bed, sometimes along a rough path at the side; in places the gully narrowed to about 6 feet between perpendicular walls and the floor was flat with small smooth shingle. About forty minutes from Safra the gully was interrupted by a double *darband* [1] marking the boundary between the lands of that village and those of Zêrun; hereabouts was a copious spring irrigating tobacco fields and we caught a glimpse of the village high up on the mountain side to our left. As it approaches its mouth the gully cuts itself another narrow passage through the rock for the last few hundred yards. We climbed out to an eminence on the left and were delighted with a charming view of the Zab itself and of the vineyards of Harzana, the last village on the Persian side, due east. We then rode north-westwards above the river along a fairly level but narrow path reinforced here and there with logs and brushwood, the opposite bank being a sheer wall of smooth bare rock, to the village of Waisa where we forded. So far we had been inclined to think that our friends had grossly exaggerated the difficulties of the Shinki route, but the zig-zag track up the other side was unpleasantly precipitous and we congratulated ourselves that the baggage had been sent round under tribal arrangements by a more normal way.

[1] In Kurdish a *darband* is generally a V-shaped gap in a ridge, with or without a river flowing through it; *geli*, a gully or gorge; *geru*, a pass over a col.

The travels in Shar Bazhêr hitherto described in this paper were all made in summer or autumn. My sixth and last visit was paid in the spring of 1929 in company with Mr. Lionel Smith, then Adviser to the Ministry of Education in 'Iraq. Our first destination being Serochik the quickest approach was to motor from Sulaimani about 12 miles south-eastwards to Arbat, and then by a rough branch road just fit for wheels for about 4 miles northwards to a point (3600 feet) at the foot of a pass over the Azmir range called Sar Kal-i Pêchan (5100 feet), where the caravan awaited us. The ascent was steep but not particularly difficult. Ten years had passed since my last visit, the troubles had long since been forgotten, and we were greeted at the top by a large and representative *istiqbal* of Shaikhs and Saiyids. We spent the first night at Gêldara and the second at Barzinja. From Barzinja we rode up north-eastwards through a forest of stunted oak to a saddle called Mila-i Mirab (6000 feet) just below the peak of Kurhakazhaw. The hill-sides were already splashed with early spring flowers. Among those I noted on the first two days out were: scarlet ranunculus; blue, mauve and white anemones; another diminutive anemone, a very small cream-coloured pansy; some medium-sized irises, cream, mauve and cream-and-mauve; as well as charlock and other common field flowers. On the next two days, north of the Kurhakazhaw range, in addition to most of these I find notes of hawthorn in blossom, aconite, celandine, grape-hyacinth, a white crocus, a bulb with a beautiful blue flower to which even Smith could not put a name, and violets. But the find that gave us the greatest joy was a clump of fritillaries at the top of the Mirab saddle. That same day we heard the cuckoo several times and I have notes of a woodpecker and a robin. On the far side of the range the dry and stony landscapes of Serochik gave way to more attractive views with fine grass on the slopes, larger oaks, and willows by the watercourses; the leaves were just beginning to come out at the lower altitudes. We started down north-eastwards by a ravine called Dol-i Gulhkê; after about 4 miles we turned east over the hill to reach the Gogasur and crossed at a ford called Buwar-i Dasht-i Kharman to Sarkan, a village of Barkêw, and pitched our tents in a field bright with flowers.

From Sarkan we crossed Tariyar by a rough track called Little-Fairy-Woman's Way (where we disturbed a herd of about fifteen moufflon) to visit Pênjwin, and returned the next day by the Pasharhê. The view from the top is one of the finest I know; eastwards in the far distance the snows of Ardelan, line upon line with several peaks rising to 9000 feet, in the middle distance the Qizilja river flowing in from Persia by a long easterly extension of the plain between Maiden's Castle hill and the heights of Chwar Bakh (Four Orchards) behind Pênjwin, then Pênjwin itself nestling in its horseshoe of green near the edge of the plain, and beyond, to the south-east, more snows; westwards, most of them glittering in fresh coats of snow except where the pinnacles were too steep to hold it, my old friends of previous journeys; within the ring a jumble of rolling country, rolling on an Atlantic scale, dotted with trees and very green. After a short, steep descent through oak forest to Badana we rode, cantering now and then, across delightful, park-like country called Dol-a Drêzh, with lush grass, bright patches of anemones, occasional streams to cross, and quite a number of pear trees in blossom (the white of pear-blossom in Kurdistan always seemed to me to have a curious, luminous quality). No villages were visible from the road, and no flocks, but there were patches of cultivation between the oaks. After about two hours from Badana, having the Band-i Mama Khalan on our right, we approached the Gogasur where the stream, sparkling in the sun as it flowed over white boulders between the bright green of the rounded

hills on each side, was looking particularly charming. We spent the night at Wuliyawa and then, touching my second route of 1919 at Pilinga, went on to Chwarta, now duly established as the administrative headquarters.

There had been light showers early the next morning and, as we rode out westwards over the downs, the fresh, moist countryside might almost have been Sussex. In just two hours we reached the Qalachuwalan flowing between willows and tamarisk through an open valley with gentle sides dotted with oak. The water was running fairly deep but we were guided to a good ford below Babakrawa and crossed without difficulty. We then followed a track on the now steep left bank up above the stream until we dropped down to Mokaba and halted for lunch in a meadow of lush grass just at the Siwail confluence. From Mokaba we continued north-westwards, for a time over low bare hills, crossing the main caravan track and my previous routes near Bayizawa, until suddenly on the sky-line at the top of a sharp rise we descried a long line of horsemen, the Pizhdar *istiqbal*, led by Abbas-i Selim Agha, brother of Babakr Agha, the paramount chief; there were a hundred of them at least, among them the lad Mamand who had attracted my attention at Dêrê eighteen months earlier. We halted under a spreading oak for tea and then rode on, with horsemen galloping backwards and forwards crossing the T of our line of march, to Gapêlon, where Abbas Agha had a large and comfortable house.

Earlier in this paper I described the fluted mass of parallel ridges on the western side of Mawat that rise to the central spine of Gojar-Kurkur. Gapêlon is situated at the base of a peak called Pir Bayiz on the southern side of a valley, generally known by the name of the village of Baliq lower down, which collects the drainage from the troughs on the south-western side of the spine to reach the Qalachuwalan near Kun-a Masi. The place was looking very prosperous with the fresh green of broad fields of wheat and barley set off by numerous pear-trees in blossom and dominated by the heights on each side. North-westwards up the troughs we could see Gojar itself, the dome rising to a point of Zhilwan, and, in the same line with Pir Bayiz, the bold peak (as it looked from this angle) of Asingeran, each of them a high point on one of the ridges. The next day, April 12, we continued our march north-westwards. At the village of Maluma, 3 miles from Gapêlon, the valley suddenly narrows; we followed the track up a narrow, stony trough between thickly wooded sides to the boundary of Shar Bazhêr at a place called Kotil. Here at Kotil, between Zhilwan and Asingeran and on the watershed, is the head of the long gully that eventually reaches the Zab as that Palko gorge which was so long believed to be the mouth of the Qalachuwalan.

SOUTH AMERICAN PROSPECT

1. SOUTH AMERICA AS A FIELD FOR GEOGRAPHICAL RESEARCH

PROFESSOR J. A. STEERS

SOUTH AMERICA has an area of 7½ million square miles, and its population is approaching 175 millions. It stretches from lat. 12° N. to lat. 56° S.; many parts of the Amazon Basin and Guiana plateau are still almost unknown except perhaps from the air, and are certainly not explored on the ground. It contains several great and fast-growing cities: Buenos Aires has a population of 5½ million, and São Paulo (more than 3 million), now the largest city in Brazil, and Caracas (*c.* 1 million) are perhaps the two most rapidly growing cities in the world. To speak of this continent in part of one lecture is in one sense an impertinence, but my purpose tonight is primarily to provoke discussion and, I hope, far greater interest in our own country in the part that South America now plays in the world —and in the much more important part she is likely to play in the future.

My own direct knowledge of the continent is limited. A few years ago I made a voyage to Valparaiso, and had good opportunities of landing at several ports, large and small, from Buenaventura to Valparaiso. This last summer I was able to make a far more extensive tour and spend some days in all the South American state capitals except Asunción and those of the three Guianas. My purpose was to make contacts with academic, official and business people, and as far as circumstances and time allowed, to find out their views about geographers from our own country making visits for research, teaching, and travel purposes to the various republics. Everywhere I found a welcome for the idea, and a real desire that geographers and others from this country should visit South America far more than we do at present. Only too often was I made aware that many people in this country are woefully ignorant of South America. I will only quote one instance: in Rio I was given a label from a parcel sent out by one of our best known publishing houses, and one associated with maps as well as books. The address on the label was "Rio de Maneiro, Brazil, The Middle East." This may sound incredible; it is, however, only one of hundreds of examples which, amusing though they may be, nevertheless help to give collectively an impression not only that we are ignorant of South America, but also that we do not care if we are. I do not want to exaggerate this kind of incident but I do wish to emphasize that it is only too easy to give an impression of indifference.

The International Conference in Rio de Janeiro last August was attended by about twenty-five professional geographers from this country. Before and after the Congress extensive excursions were arranged to cover a great deal of Brazil—a country that is larger than either the United States or the whole of Europe. In this way some of us began to learn something of Brazil. I must emphasize as forcibly as I can, that it is only by visiting a country and by actual study and discussion on the ground that a geographer—or anyone else for that matter—can obtain a reasonably balanced picture and opinion. Clearly, the longer and more comprehensive he can make his visit the better, but even the short visits made possible by these excursions have helped greatly to this end. Moreover, by his training in the evolution of landscape, in discerning regions, in studying settlement

patterns, in short in reflecting continuously on the relation of man to his environment, a geographer should be able to appreciate and make clear to others what he has seen. What is even more important, he should be able to make his audience interested in the country of which he is speaking, and so cause his students to think and read for themselves and consider whether they might make their careers in the country in question, or in some way closely associated with it. It is my hope that the beginning already made will open up ways and means for geographers to visit and study in South America far more than is the case at present.

If we examined the Society's library, we should find a considerable number of travel books written and published in Britain on South America. Some of these are very informative and of great value: for example, Lord Bryce's 'South American observations and impressions' is known to many. We should also find a valuable collection of older works, partly historical, partly topographical in content. But we should find remarkably few books dealing with the geography of the continent, in the way in which we think of it, apart from official publications, such as 'The South American Handbook,' 'The Republics of South America' and the series in course of publication by the Royal Institute of International Affairs. There are, indeed, good historical works by Kirkpatrick, Humphreys and others—but these are not concerned with the country, nor with interpreting that country to others. If, on the other hand, we assess the American contribution, we shall find a very different state of affairs—and we shall see at once how much more they are concerned with South America than we are. It is also relevant to state here that we, in this country, are perhaps not sufficiently aware of what is written on our own subject by South American geographers. Those of us who were in Rio are now far more cognizant of the material available, mainly in Portuguese, on the geography of Brazil, and of its exponents in Rio, São Paulo and elsewhere. My own visits to other capitals introduced me not only to geographers, but also to some first-rate written works, and to several societies which publish, perhaps somewhat irregularly, useful and informative journals. Moreover, there is a real interest in the subject. I would mention especially the university departments at Buenos Aires, Santiago, Montevideo, Lima, and Caracas, and the geographical society at Bogotá. Relevant to this point also are the rapid strides that are being made in preparing good topographical maps. These—I must generalize—are made largely by air mapping in relation to ground control. In Santiago, Lima, Bogotá and Caracas, I visited the institutions producing these maps, and saw modern stereo-plotting instruments in full use. The organization and much of the work has usually been under direct guidance, expert as well as financial, of the United States and is, in a sense, a direct result of the American Geographical Society's 'Map of Hispanic America on the Millionth Scale,' which is so closely associated with the name of Isaiah Bowman. But the several republics are gradually taking over the work. Allowing for the enormous areas, and the great difficulties of the terrain, much has already been accomplished, and some excellent topographical maps are just beginning to appear.

During the last century people from these islands played a great part in the opening up of South America. A study of the railway development, particularly in Argentina, is largely a study of British enterprise. We were also often responsible for the building of docks and harbours, and in financing business enterprises far too numerous to detail here. Two of the main British shipping companies serving South America, the Royal Mail and the Pacific Steam Navigation, have played a great part in opening up the trade of the country. The announcement of the building of

three new ships for the former company and the recent addition of the *Reina del Mar* to the fleet of the latter are welcome acts of faith in the potentialities of trade with South America. In banking, too, this country has played a great part, and the Bank of London and South America is now extending its range. Despite these and many other facts and instances that could be cited, it is regrettably true that in recent years the influence of Britain, both relatively and absolutely, has greatly declined in South America. This is largely the result of the two world wars, especially of that of 1939–45. Financial difficulties—and this is an oversimplified statement—made it necessary to sell many of the British-owned railways in Argentina and elsewhere. Other and similar instances are not difficult to find. Unfortunately, however, circumstances or inclinations, or both, have been against our making great efforts to regain our former place in the economy of South America. Other nations, especially the United States, have taken our place; and the United States, partly through contiguity, partly perhaps with the Monroe Doctrine in mind, certainly as a result of dollar-versus-sterling economy, have gone far ahead, and are still doing so. Their influence penetrates deeply into almost all aspects of life, and their generosity has led to great developments outside the purely commercial world. European nations, too, are taking an increasing and enterprising interest in the continent. Partly for the reasons given above, partly for others involving the Commonwealth and the Middle East, we have fallen back. Can we afford to do so?

The *Economist* (16 February 1957) in a short article from a correspondent in Rio de Janeiro puts the matter of Anglo-Brazilian business relations very tersely:

"In the new wave of investment there have been only a few drops of British money. Although for British interests, there are understandable objections and limitations to investment in Brazil, there is also a stolid scepticism and an almost defiant ignorance in the United Kingdom about Brazil, which Brazilians put down simply to disinterest bred by inability to compete. Brazilian buyers and manufacturing interests often do not now think of Britain as a possible supplier or partner; visitors from London are sometimes brought up with a jerk when Brazilians, showing them round shining new German-equipped factories, assume sympathetically that as Britain 'has fallen so far behind competition,' their visit is a sightseeing, not a business one. As Brazil's policy is to favour first-comers many British manufacturers have probably by now lost their chance. In the meantime, well-known German, Swiss, Italian, French, Swedish, American and Japanese undertakings set up local subsidiaries to produce everything from steel to paper, jeeps to bicycles, chemicals to fountain pens."

South America's population is increasing more rapidly than that of any other continent, yet it is still largely an empty continent. European immigration remains high, and the old view that much of the continent is either unhealthy or unsuitable for settlement is rapidly giving way before the advances of science and medicine. We are still apt to think of South America as a continent of revolutions and disastrous earthquakes—but it is as well to try to picture such things in relative terms. Disastrous earthquakes have occurred, and doubtless will again. But modern buildings can very largely resist them. Revolutions have occurred, and there may be others, but seldom are they on a big scale, and may not affect more than the capital city or one or two big places. They are regrettable, but the loss of life accompanying them is far less than that on our own roads, and only too often their nature and effects are much exaggerated. My own short visits could not fail to impress upon me the rapidity of change and development in the capital cities, and

also in some of the smaller ones. Much of the "country" is backward, a great deal is primitive and even unknown. But conditions are rapidly changing. All the republics are highly air-minded, and Brazil and Colombia, to take but two examples, are in a rapid process of transformation as a result of air travel. How far it can replace land travel for heavy and bulky goods is debatable, but isolation has disappeared, and with it has developed a desire, and thus a market, for more and more goods. But road and railway building must go ahead—and so also must maintenance. Railways, roads, air lines, and the capital to develop them, are and will be wanted more and more in South America. They will tap the vast resources whether mineral, oil, or food that await development. Here, as well as in the great steel works of Chile and Brazil, in the oil refineries, and in the building of pipe-lines, port works, irrigation dams, and underground railways in some of the big cities, should be a large and expanding market for our own industries.

Let me turn next to some reasons for believing that geographers can make a real contribution to the education and interests of Great Britain in South America—provided always that it is possible for visits for research and related purposes to be made. It may not be sufficiently realized outside academic circles how geography as a discipline has developed in our universities. It is relevant here to say that in all our universities there is now a flourishing school and that the number of students reading the subject continues to increase. But no teaching of regional geography can be effective, in the fullest sense, unless it is given by someone who has had practical experience of field or research work of some kind in the country about which he is speaking. It is axiomatic that the chemist or physicist has experimented in a laboratory. For a geographer the surface of the globe is his laboratory. Clearly he cannot know more than a small fraction of it, and for some types of geographical work a comparatively limited knowledge of a small area may suffice. But most regional and all world problems must be studied on a different scale. It matters not whether they are primarily economic, historical or physical: they will all be more adequately and faithfully dealt with if the teacher has travelled and is able not only to speak of a country from direct knowledge, but also to compare conditions in different countries. It is one of the primary tasks of geography to study the region. There is no need to define this term precisely in the present context, but it will suffice to say that there need be no rigid upper or lower limits to its size provided that it can be adequately studied. A good regional study, involving as it does a proper appreciation of man and his works in relation to the background of structure, landscape and climate of the area, should give to those who read it an overall picture that can be understood and used as a basis for scientific and business enterprise. Apart from the written word, the proper teaching about a region is perhaps even more important, since with the aid of good colour, or black and white illustrations, the audience can be given a truly comprehensive picture. The field work required for this is often both extensive and intensive, and the worker must know his ground intimately. No other study emphasizes in this way the relation of man to his environment, but naturally the geographer is greatly indebted to, and must seek the help of others—the geologist, anthropologist and sociologist.

As a result of the careful investigation of a relatively small area, the geographer can get the "feel" of a country far better. No one would claim that a worker in, *e.g.*, the Caatinga of north-eastern Brazil could properly appreciate the Yungas of Bolivia. But if in addition to detailed work in one district he is able to travel more generally in far wider areas, there is no doubt that he should be better able to

understand much more of their geography than anyone who has not had the opportunity of intensive field study. Moreover, the reading of whatever accounts may exist of the regions less well known to him, will undoubtedly be far more real as a result of his own work. Translated into terms of academic or other lectures, it should mean that a geographer who has had this opportunity should be able to make some part or parts of South America "come alive." If, as I believe, genuine interest can be produced in this way, I am sure that, given time, an increasing number of people who study geography in our universities will develop a desire to visit and work in South America.

South America presents unlimited problems for the geographer to investigate. That great American geographer, Isaiah Bowman, in his work on 'The pioneer fringe,' introduced a subject which needs more and more study—how and why are new lands opened up? Conditions in Argentina differ enormously, from the Patagonian plains in the south, through the central Pampas to the northern sub-tropical areas. These again are quite different from the problems facing Brazil in the Amazon basin, or Peru in its three main regions—the coastal desert strip, the mountains, and the equatorial forests on the east of the Andes. These again differ from the setting of Colombia, one of the most interesting states in the continent. North, central, and south Chile offer entirely different circumstances —and so do the other republics.

Gilberto Freyre has shown the complex background of Brazilian society, but there remains almost unlimited scope for understanding how this society is adapting itself to the land of Brazil. There are contrasts between the great cities of Rio and São Paulo and those in the north-eastern part of the country; and the development of individual cities, and of those parts of the country in which a large number of Japanese or Germans live—still in relatively if not absolutely socially distinct communities—are aspects which need study.

In Bolivia, Peru, Ecuador, Colombia, and Mexico the study of the relation of the Indian peoples to the remainder of the population has scarcely been touched. I do not underrate the importance of the extensive American work on the Indian population of the Andean area, nor the early work of Bowman and latterly that of Bushnell; I merely call attention to the vast amount that remains to be done.

Another extreme that we find in Uruguay is a welfare state more advanced in some respects than our own. It is true that there may be occasional lapses in practice which cause difficulties, but the advanced nature of the social services throughout the republic stand in abrupt contrast to those in *e.g.* Bolivia or Ecuador.

The historical geographer will find almost a virgin field for study in the early colonial period and the relation of the Spanish or Portuguese settlers to the native peoples. Especially is this the case in the former country of the Incas. Anyone who has visited Cuzco, Machu Picchu, Quito, or Arequipa is made to realize even during the most superficial visit how much awaits attention. In Paraguay the development, influence, and fall of the Jesuit missions and their effects on the local inhabitants present great possibilities for research. Another aspect of particular interest in South America is the study of urban geography. The visitor is soon made aware of the speed with which changes take place—and it is regrettable that there is not always sufficient respect for the old and beautiful in the desire to modernize the cities. Studies of the growth and development of Caracas, Lima and Santiago—in fact of any important city—would be most rewarding.

Industrialization is proceeding so rapidly in many of the republics that an Industrial Revolution can be studied in action. The steel mills at Volta Redonda

and Huachipato are two examples. There is also scope and necessity for research in areas which are now being developed—for example, the Montana of Peru, the Guarico basin of Venezuela, and the northern Paraná and Goiás regions of Brazil. These are by no means the field only of the economic geographer: the proper understanding of the use of these very different parts of South America implies research in physiography, climate, vegetation, soils, agriculture and settlement. The Guarico basin may well become one of the world's great reserves of cattle. But little geographical work has yet been done in detail; only general descriptions of the nature and potentialities of the region are available. Moreover this development, industrial or agricultural, needs study in relation to overseas markets.

The broad physical features of the continent, especially the great divide of the Cordillera, makes a study of the space-relationships of the several republics and of their constituent regions all-important. Until quite recently, that is, up to the time of easy air travel, it was simpler for people to go from Lima to Iquitos via the Panama Canal and up the Amazon than it was for them to go overland direct. The Panama Canal has brought the west coast far closer to Europe and to the eastern United States, but Valparaiso is now the end of the journey and not as it was formerly, an important port of call *en route* for Callao. Political changes have cut off Bolivia from the sea; they have not in any way altered the difficult journey for goods from La Paz to Antofagasta, Arica or Mollendo. Air travel has done much to unify Colombia, but land travel between Buenaventura, Cali, Medellín, Bogotá and the north coast ports remains slow and difficult. Ease of air travel must not blind us to the virtual impossibility of cross-country surface travel in many, in fact most, parts of the continent. The visitor to Caracas, Bogotá, or São Paulo or any other big city will have a very superficial idea of transport unless he tries to go far inland by any other means than air. It is interesting, too, to realize that the great and new cities of Brazil are primarily linked by air, and not, as in Europe, by road and rail.

South America is, and will long remain, a continent of violent contrasts. It is little more than one hundred years since the republics gained independence. In that time much has been done, but the degree of illiteracy is still very high in some parts—and despite the great efforts that are being made in education it is likely to remain so. The contrast between rich and poor needs no emphasis: the most casual visitor to, say, Rio de Janeiro cannot fail to be struck by the fact that luxury flats are often within almost a stone's throw of the slums of a *favella*. Similar startling contrasts occur just outside Lima on the road up the Rimac valley. These and other items of like nature are mentioned in no sense of moral superiority, but to emphasize that despite the fact that South America was discovered and colonized in the fifteenth century, it is still "new." It is, and will long remain, a land demanding every skill in its development.

It is not only a country that has enormous potentialities for development, but it is one in which visitors from this land will find a welcome. Can we afford not to know far more about it than we do? It is easy to travel in the continent in the sense that political barriers do not exist as in much of Eurasia. Air transport has made it possible not only to reach any capital from any other within twenty-four hours, but also has given access to remote areas in the mountains, plains, and even the jungle. Another difficulty that is relatively light in South America is that of language. It is true that English will take the traveller a very long way, but if he wants to understand the country and its problems he should know Spanish or

Portuguese or both. But this is a far simpler proposition than travelling in, say, Eastern Europe, with its multiplicity of tongues.

I have tried to show the importance of geographers studying in South America. The movement need not, and should not, be all one way. We can offer to the academic world of South America, whether geographers, or others, facilities for research and its techniques that are not at present available in that continent, and at the same time we can benefit very much from South American scholars visiting and lecturing in our own universities.

2. BRAZIL; A GEOGRAPHER'S VIEW

PROFESSOR L. DUDLEY STAMP

The International Geographical Congress in Brazil (to which Professor Steers has referred) may well prove an historic starting point in the revival of interest in South American geography to which so many British geographers are now looking forward. The Congress itself has an interesting history behind it and I would like to say something about this, and about the Congress itself, before dealing with the geographical prospects which Brazil itself offers.

The first International Geographical Congress was held in Antwerp in 1871, and others were held at intervals of three or four years for some time after that. Then there came into existence the continuing body, the International Geographical Union. The late Sir Charles Arden-Close, who was President of the International Geographical Union for the period culminating in the Congress in Amsterdam in 1938, has given to this Society the history of the early development of the International Geographical Union and of the successive Congresses. The Congress which was held in Washington in the United States in 1952 was the seventeenth International Congress but only the eighth General Assembly of the International Geographical Union. It was at the General Assembly in Washington that the invitation to visit Brazil for 1956 was accepted. Once an invitation has been accepted it becomes essentially the function of the host country to carry out the necessary organization and preparation. The host country makes all the local arrangements and draws up the programme for the meeting, the arrangement according to statute being that the programme is subject to general approval by the Executive of the International Geographical Union itself. In the case of the visit to Brazil the liaison was particularly close because Professor Hilgard O'Reilly Sternberg is not only one of the Vice-Presidents of the International Geographical Union but he was the Organizing Secretary of the Brazilian Congress.

Politics play a larger part in scientific affairs in Brazil and in other Latin American countries than we are accustomed to observe in present-day Europe. For that reason an important step forward was made when Brazil set up a Brazilian National Committee embracing, just as it does in this country, all the various bodies which were concerned and interested in geographical work, both Government bodies and universities. Similarly a law was passed recognizing the International Geographical Union of which particulars are given in the Appendix (p. 340) as a non-political international body on the same footing as the Red Cross or the Boy Scouts. This meant that grants made to the Congress organization by one government would not be immediately upset if there were a change of government. Throughout the four years of organization Professor Sternberg remained as Secretary-Treasurer

and Organizer, but there were four successive Chairman of the Organizing Committee. The Chairman, or President, of this Organizing Committee, who functioned during the period of the Congress, and who played such a very large part in its success was Professor Ferreira.

The Brazilian Government made the most generous grant of 8 million cruzeiros, approximately £40,000 at the then current rate of exchange, to make the Congress possible, and generous grants were made by the city of Rio and by other organizations, and throughout the country the costs of the official excursions were enormously reduced by innumerable concessions which were afforded and hospitality which was offered. It is perhaps little known, even to the participants, how much is owed to the extremely generous attitude towards the Congress which was shown throughout the country. Ideal conditions for the Congress itself were afforded by the accommodation offered by the great Naval Academy, occupying a former island in the middle of Rio harbour, very conveniently connected with the main city centre by a causeway. Excellent accommodation, normally used by cadets, was offered at a nominal fee, together with full board, by the Naval authorities and was much appreciated by the male delegates from many countries. As President of the International Geographical Union it was my privilege to see much of the work which went into the organization of the Congress before the actual beginning of the proceedings, and I personally appreciate enormously the great help which was given from every quarter. The interest of the President of Brazil himself, who received the delegates and who personally opened and spoke at the Inaugural Celebration in the Opera House, must be recorded.

For my own part, the meeting in Rio in 1956 had a particular interest, because my first visit to Rio was twenty-two years ago, in 1934, and I was able to make comparisons which suggest the extreme rapidity of change and development in this great country of Brazil. In the course of these twenty-two years the population of the capital has swept up from something like ¾ million to about 3 million. The site of Rio is so familiar from pictures that it really needs no explanation of mine: its original discoverers called it Rio de Janeiro—January River—but in fact the great harbour is not the estuary of a great river as its namers thought, it is a natural feature of a submergent shore. The entrance to the harbour, with its spectacular mountains rising around, notably the almost isolated Sugar Loaf, is through a comparatively narrow entrance by one of two channels. The city grew on whatever relatively flat land was available on the western side of this magnificent harbour. In 1934 one ascended by the famous cable car to the top of the Sugar Loaf and there was Rio stretching out before one, backed by the almost precipitous cliffs, which are crowned by the giant statue Christ-Corcovado. In 1934 a trip to the nearby Atlantic beach, the 3-mile stretch of Copacabana, revealed some large hotels, numerous mansions standing in their spacious grounds, beneath the shade of waving coconut palms. In the harbour of the bay itself one's eye automatically caught the island of Villegagnon with its fortress-like Naval School. Fine hotels, private houses and some offices flanked the sweeping drive of Flamengo, with the beautiful waters of the bay on one side and the sweep itself lined with palm trees and with beautifully kept black and white marble pavements, arranged in those agreeable wavy designs which one associates particularly with Lisbon. Looking across the bay one could see the buildings of the town of Niteroi, actually the capital of the state of Rio de Janeiro, whilst the wharves and quays used by the ocean-going vessels were discreetly tucked around the corner hidden from Flamengo and the picturesque front of the harbour itself.

The year 1956 presented a picture which was different in many respects. Nothing can change the magnificent setting of Rio, but many of the hills which formerly seemed to dominate the town, with their precipitous sides, are now virtually hidden by the gigantic blocks of apartments towering to their twelve and fourteen storeys. The statue of Christ still towers over the whole, the cable-car still runs to the top of the Sugar Loaf and gives one an unrivalled view of the near part, but the mountains which formerly seemed to limit Rio on the landward side have now become surrounded by a sea of buildings to such an extent that they seem but islands in a human-made landscape. The last three or four large private houses along the Copacabana beach are at the moment being pulled down, all the others have been replaced by blocks of apartments and hotels, rising to a uniform skyline of about twelve or fourteen storeys high. Skyscraper apartments extend inland so that the streets which run parallel to the sea have the cavernous nature of downtown New York. Suburban Rio has stretched beyond Copacabana along the open front of the Atlantic Ocean. Ipanema and Leblon are fast becoming as populous as Copacabana itself. In the harbour the island on which stands the Naval School is no longer an island. A large stretch of reclaimed land is now the city's airport—the Aeroporto Santos Dumont. This airport serves only the local traffic to different parts of Brazil. The international airport, which is further from the city, is on another island in the heart of the bay. There must be many airports in the world which claim to be the busiest, but surely the municipal airport of Rio has a fairly good claim. On more than one occasion during our stay we counted no less than ten planes in the air at once waiting to land. Intervals of not more than a minute separated landings and arrivals from all parts of this vast country. A part of that wonderful seaside promenade, the Praia do Flamengo, still goes along by the side of the sea, but not all, for here again land is being reclaimed and soon the Praia will be an inland street. It is only right to record the sad side of the story. It must be admitted that private building has tended to outrun the development of civic facilities. No longer are the pavements kept in that beautiful and spotless condition which was characteristic of twenty years ago. The water supply which was then adequate is insufficient to meet the needs of three million people, and many who occupy luxury flats find that the water supply is only a reality for a part of the week. As elsewhere in the world the old trams are doomed to extinction, and no effort is being made by their foreign owners to bring them up to date. They are obviously replaced by the enormous numbers of motor buses. Transport is a real difficulty. Perhaps in no other city in the world is it as difficult to get taxis as it is in Rio, although when obtained it must be admitted that they are not expensive. The pace of life too has changed; it would be difficult to find another city where the traffic travels at the speed which it habitually does in so many parts of Rio.

The Portuguese flavour which is characteristic of the older buildings and of the old decorated pavements has given place now to what may be called a Brazilian style: modern, effective and efficient. The vast numbers of huge American cars are an indication of the standard of living characteristic of so many of the inhabitants of Brazil's capital. Opulence and luxury are everywhere apparent, but existing cheek by jowl with some of the newer, more fashionable suburbs of Rio there are still the squatters' settlements, insanitary, without any piped water supply, without any main drainage, and consisting of wooden or patched corrugated iron huts which clamber up some of the less accessible hillsides. Rio is quite aware of the existence of these slum quarters and they are steadily disappearing. They do

serve, however, to remind one of the extreme contrasts between wealth and poverty which are found in other parts of this country.

Is there a colour-bar in Rio de Janeiro, and indeed in Brazil as a whole? This is a question which one finds is extremely difficult to answer. Theoretically no, and on the whole one may say that a man is accepted on his own showing on a basis of culture and education. On the crowded beach at Copacabana, where various games are in progress most of the sunny mornings, one sees every shade of skin, mixing apparently quite happily together. For census purposes the population is divided into white, half-caste and negro, but there is every graduation between the three. On the whole, the negro population and the darker skinned population is to be found in the slum quarters, and it is relatively rare to see a really dark skin amongst the inhabitants of a fashionable block of flats. But there is in fact no direct impossibility where this is concerned. The European strains, dominated by Portuguese, Italian and German, may be said to have disappeared into a nation which is essentially Brazilian. But whatever their colour, rich and poor alike, there is little doubt that the Brazilians are a sport-loving nation. Whenever the weather is tempting, and this is very frequently, the bathing beaches are crowded with young people whom one would have expected to have been in offices or factories. Presumably work is restricted to the less clement weather, and a geographer here may detect something of the influence of the tropical climate. Similarly, all sporting events attract a large audience.

It is rarely that one can say of any country that the capital is typical of the country as a whole, and this applies in a considerable measure in Brazil. On the other hand it may be said that Rio as the capital is typical of one great feature of the country—the prevailing urbanization. In extent, in size and in the magnificence of their skyscraper buildings, Rio and São Paulo are close rivals, but it is the newer towns of the coast or the interior which cause the greatest surprise to the visitor. A very typical example is the now great city, approaching half a million inhabitants, of Belo Horizonte. After travelling for three days over the almost impossible roads which until this year were the only ones to the capital—all normal people naturally going by air—one finds, not the pioneer town which one expects, but a great skyscraper city. It is the capital town of the State of Minas Gerais and as such is the seat of the university of that State. The university has its principal quarters on the twentieth floors of the television and radio building in the heart of the city. But magnificent as this building is it is only one of many skyscrapers in an urban centre which nevertheless can be matched by many others of the rapidly developing urban centres of Brazil. It must be recorded that one can easily get to pioneer settlements which have not yet reached the same stage, but which are rapidly following the same pattern. Some of us had a most interesting time at Governador Valadares, rapidly developing a civic life, with manufactures of its own, and one sees in it an incipient Belo Horizonte; and this is true of many other places which are scarcely known to Europeans and which have hardly yet appeared on the atlas maps of the world.

But so often this marked urbanization is being accompanied by rural depopulation. In part, depopulation is due to the exhaustion of fertile soils, and the shift of the coffee belt from one area to another, but there are actual areas formerly cultivated which are now occupied only by very indifferent farmhouses where one sees rural poverty, and where there is much abandoned land. Here, children and adults alike go barefoot and the conditions of living in many of the rural areas are those which one associates with the poorer parts of the East rather than with the New

World. On the other hand, the successful coffee plantations and other large estates maintain a standard of living in its own way quite comparable with that enjoyed by the wealthy in the towns.

Side by side with urbanization is the development of industry, which is undoubtedly characteristic of Brazil at the present time. The improvement of communications is making it possible to reach the rich mineral deposits of the interior, and Brazil is passing from the stage of exporting raw materials into that in which they are processed at home. The recent development of the heavy iron and steel industry deserves a whole study to itself, but it is certainly a most remarkable feature of this outstanding country. The early pioneers were foreign nationals and the capital came from overseas. At the present time there is either the working out of a *modus operandi* with the Brazilians or the taking over of the industrial development by the Brazilians themselves, using their foreign friends in the way in which they consider desirable for the development of their country. But there is no doubt of the intense nationalism in the sense of "Brazil for the Brazilians," and "Brazil first," which characterizes the development of this young country. Certainly there are some remarkable examples of heavy iron and steel industry, not only the important works at Volta Redonda, and those at Itabira, but still more, at Monlevarde where the giant iron and steel mills depend entirely for their fuel on vast supplies of charcoal collected from the neighbourhood and for the preparation of which huge eucalyptus forests have been planted. Side by side with heavy industries a whole range of light industries is springing up and these are often the mainstay of new pioneer settlements. Governador Valadares, to quote the same example again, has its sugar mill, its plywood factory, and so on. Brazil is a vast country of 3 million square miles—larger than continental United States. It is obviously difficult to know the exact population, but it is certainly growing at an extremely rapid rate—far greater than that which characterizes the world as a whole—and the total is certainly now over sixty million. Of these it is true that three million are in the capital, three million in São Paulo, and a large proportion of the others in the major cities, leaving very large parts most sparsely populated. Indeed, the contrasts are extreme. There are still very large parts of the interior which are virtually unmapped, one might almost have said unexplored, but in these days the [illegible]ne gets everywhere and air photography has to some extent changed this position. Two or three decades ago most parts could be reached only by rough trails, and rivers where such were available. Then came the development of railways. Today the railways are inadequate for the burdens put upon them, but they are important for the transport of heavy materials, such as iron ore, from the interior to such ports as Vitória. Comparatively few passengers use the long-distance trains. For passenger use the motor and the plane come into competition as soon as a new road is constructed. The use of air transport in Brazil is certainly quite amazing. One can go from Rio to almost any main centre, often by several air services a day. And similarly there are air links all over the country. Road-making is proceeding apace, with the latest of earth-moving machinery and the construction of really magnificent highways; but it is a vast task which still remains.

Anyone who visits Brazil can scarcely fail to come away with the impression that here one of the great giants of the earth, which has been sleeping for some time past, is now awakening and developing with quite incredible vigour. It is a country of vast resources of land, vast resources of minerals, and a vast potential for people and production. Both visitor and resident may be critical of what may be called uncertain political and economic developments, a certain air of instability perhaps,

associated with the youthfulness of development. The fact that for some overseas investors the story of economic development in Brazil has not been a particularly happy one should not be allowed to blind us to the enormous potential of this great country.

APPENDIX

The affairs of the International Geographical Union are in the hands of the Executive. This consists of a President, a senior or first Vice-President, six other Vice-Presidents and a Secretary-Treasurer. The period of service of the officers is from one Congress to the next, but the general rule is that a Vice-President either becomes the President or serves for a further period, usually between Congresses, as Vice-President, making eight in all. If elected to the Presidency the President automatically becomes on his retirement a Vice-President, so that in his case the period of service is normally twelve years. The Secretary-Treasurer can be elected for successive periods. The burden of regular work falls heavily upon the Secretary-Treasurer and his small Secretariat. This work was carried out most effectively during the two periods from Lisbon in 1949 to Washington 1952, from Washington 1952 to Rio de Janeiro 1956 by Dr. George H. T. Kimble, first of McGill University, Montreal, and latterly transferred to the Twentieth Century Foundation in New York. He has been succeeded since the Rio Congress by Professor Hans Boesch of the University of Zurich. There is no individual membership of the International Geographical Union, the membership is one of countries, but the Executive naturally is one of individuals and it may be said that the Executive is a self-perpetuating body in that it makes proposals for new Vice-Presidents, proposals which are put before the General Assembly and voted into office by them. It is necessary that the members of the Executive should represent as widely as possible the adhering nations, should represent the various phases of geography, but at the same time it must not consist of figureheads, and it may happen that a man has reached great distinction in the geographical world but at such an age when the heavy calls of travel all over the world to attend meetings of the Executive makes his effective use virtually impossible. It is necessary therefore to find young and energetic geographers who are able to enter fully into the exacting tasks which fall to the Executive. Even if it means a meeting only once a year, or twice between Congresses, travel from all parts of the world is involved.

About forty countries adhere to the International Geographical Union. They may adhere in any of the Categories I to VIII, the difference being simply the annual dues which are payable. Those in Category I pay the equivalent of $100 U.S., those who adhere in the highest Category VIII, pay $1,500 with a scale in between. It is laid down in the Statutes that the adhering body in the country concerned should normally be the Academy of the equivalent senior scientific body. It is obviously essential in an international scientific body to avoid any control by politics, so that a government department is not normally regarded as a suitable adhering body. In any case the country which adheres is asked to set up a special National Committee for Geography which shall handle the affairs of that country vis-à-vis the International Geographical Union. The British National Committee for Geography includes representatives of various bodies in this country, scientific bodies as well as government departments which have an interest in matters geographic, and it is one of the committees of the Royal Society. The Royal Society can thus be described as the adhering body as far as Britain is concerned. In our own case difficulty arises as to whether or not the adhering body should include representatives of the Colonies and the non-self governing parts of the British Commonwealth. Many of these now have geographers who have never in fact set foot in the British Isles and it is largely for that reason that at the last Congress a new class of Membership was set up, namely Associate Members. At the Rio Congress the General Assembly elected to this new category six members: French West Africa, Nigeria, 'Iraq, the Sudan, Uganda and Kenya. The character

of the countries concerned, which are now developing geographical studies, but in which there are only a small number of trained geographers, will make clear the reason for Associate Members.

All communications between the Secretariat of the International Geographical Union and member countries then comes through their National Committees. The *Newsletter*, for example, is sent in bulk to the National Committee of each country. Membership of an actual Congress is by individuals; each individual attending is expected to pay the Congress fee, but usually the National Committees sponsor their delegations and supply lists of those who will be coming on behalf of the country. Generally the National Committee for Geography names one of its delegates to act as leader, because in the General Assembly voting is by country. One country, one vote, independently of the Category in which the country concerned adheres. Associate Members have no vote.

The General Assembly of the Union, meeting at each Congress, is the body which officially sets up the scientific Commissions. These Commissions form a very important part of the work of the International Geographical Union. They are allotted specific tasks for investigation which are regarded as of international significance and are of vital importance, and as far as possible the Union grants funds from its own resources or from resources which are made especially available by such bodies as UNESCO and ICSU. The Executive of the Union regards itself as responsible for stimulating geographical work all over the world, it keeps its member countries in contact through the *Newsletter*, and a new departure was made by the last Executive in holding a special Regional Conference on the problems of tropical Africa which was staged at the University College of East Africa at Makerere in September, 1955, and of which the Union issued a full report. The Regional Conference which is being arranged by the Japanese National Committee, to be held in Japan in August and September, 1957, is also carried out with the blessing of the Union.

DISCUSSION

Evening Meeting. 29 April 1957

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: In the last Session we have had at least four evening meetings and, I believe, two afternoon meetings dealing with South American subjects; and we have now got in our Exhibition Gallery a very fine exhibition on the geography of Venezuela, in connection with which we have had the technical help of the Shell Petroleum Company, whose photographic unit has produced the most beautiful photographs of Venezuela. That is only one type of development which is going on in South America today.

Last August the Eighteenth International Geographical Congress took place at Rio de Janeiro and this country was represented by one of our leading geographers, Professor Steers, who occupies the Chair of Geography at Cambridge University. By a fortunate coincidence that Congress was held under the auspices of the International Geographical Union, whose President last year was a very well known and great British geographer, Professor Dudley Stamp, who occupies the Chair of Social Geography at the London School of Economics, University of London. So we had two first-class British geographers attending at that Congress. Although we could not send to it a very large team of British geographers we were very well represented because we had, I might say, our two leading British geographers there, and they are going to talk to us tonight. First of all we shall have the pleasure of listening to Professor Steers and he will be followed by Professor Dudley Stamp.

Professor Steers and Professor Dudley Stamp then read their papers

The PRESIDENT: This evening our "duet lecture" was entitled "South American Prospect" and I think you will agree with me that we have been transported on a magic carpet to a continent which to many of us is comparatively unknown. In your

name I should like to thank our lecturers for the really fascinating talks they have given. The new Brazilian Ambassador is due to arrive next week, but we have here in his place the Brazilian Chargé d'Affaires, Senhor Castello Branco, who speaks English much better than I do and I have no hesitation, therefore, in asking him to say a few words.

Senhor A. B. L. CASTELLO BRANCO: I am very grateful to the Royal Geographical Society for the opportunity to be amongst you here tonight, and, after an excellent dinner, to listen at first hand to the impressions of two of those who took part last year in the International Congress of Geography in Rio de Janeiro. We were very proud indeed to have been hosts to so many eminent geographers from all over the world and to have been able to show them our country, and I think I am safe in saying that nothing could have been more in our own interests. I am convinced of that after listening to the admirable lectures given to us tonight by Professor Steers and Professor Dudley Stamp. I confess I was entirely carried away by the fascinating accounts given of the land and the people of which they spoke, and I do not believe that this was due to the fact that they are my own land and my own people. I am quite sure that our lecturers by their clear expositions have kindled your imaginations and that you will now want to know more about the country and to meet more of the people from across the Atlantic.

Professor Steers spoke of British influences. We deeply appreciate the effect of British civilization in our country and are grateful for the contribution which your countrymen brought there long ago. This can and should continue for our mutual benefit. After listening to these lectures I realize the important part you geographers have to play in reviving interest here in the possibilities which are open to all in Brazil, to the peoples as well as to enterprise. I sincerely hope that many geographers will be stimulated by those who were present last year at the Congress. I am convinced that geographers can make an invaluable contribution, perhaps the most valuable of all contributions, to maintain the very close relations which have existed for so long between our two countries.

The PRESIDENT: During the Congress last year we had as our Ambassador in Rio Sir Geoffrey Thompson, who is with us tonight.

Sir GEOFFREY THOMPSON: We have heard tonight two most eloquent and interesting speeches on the subject of this great continent, and there is very little that I can usefully add to what has been said. I should, however, like to leave you with three thoughts about this great New World which is so vast that it is very difficult for any of us really to grasp its size. When one considers that the country of which we have heard most tonight, Brazil, is bigger than the United States and is the third or fourth country in area in the whole world, and that it occupies one-third of the Latin American continent, one gets some idea of what is meant when a paper such as the *Economist* describes the continent as developing more quickly than any other area in the world. It is not only material and economic development: it is also political development. In that vast area there are about twenty different and separate sovereign countries and each is represented at the United Nations. We have played in the past a considerable role in helping all those countries towards achieving independence. As a result, there has endured among them, as I am sure my friend the Brazilian Chargé d'Affaires will agree, during 150 or more years a great feeling of goodwill for Britain and the British. Goodwill in the modern world is a priceless asset and it does not exist in every country towards us.

The second thought which I should like to leave with you is that within the memory of a number of those who like myself are present here tonight is England with three million unemployed. I think we are in danger of forgetting what that meant some twenty-five years ago to the people of this country and that it was due to stagnation in trade. Here is a vast continent that is crying out for capital equipment of every kind. Here is a vast continent developing extremely rapidly in the dawn of the Atomic Age. The harnessing of nuclear energy for peaceful purposes, in which this

country is happily in the lead, is going to revolutionize life not only here but also in Latin America. It is going to decrease the gap that exists there between wealth and poverty, and we are in a position to collaborate with the Latin American countries in bringing this new power to that area for the benefit of its people.

The third thought is that here in Britain we are sometimes, in my opinion, apt to be a bit slow in recognizing how things are changing. The East, in which I have served, as well as the West, is very familiar to us. Anything that lies east of Gibraltar is to us something we seem instinctively to have heard about or known about, and east of Gibraltar lie what are called the traditional markets of Britain. There is no country in the world which relies more on overseas trade than Britain. Those traditional markets are, as we have lately seen, affected by political troubles. Are we wise to go on with indifference to this vast area that is crying out for our collaboration, both scientific and material? That leads me to just one other thought. I would hope that it may be possible for this great Society, which has done so much to spread knowledge amongst us and amongst others, to collaborate with some of the leading universities of the Latin American continent and perhaps attract over here Latin American students to see something of our country and life and to learn something of our scientific attainments. Similarly, we could send students out to Brazil, Argentina, Chile, Peru, Venezuela and other countries to learn what they can of this modern and brave new world.

EXPLORATION IN THE NORTHERNMOST ANDES

ALLAN CUNNINGHAM

ON TWO PREVIOUS occasions, meetings of this Society have been addressed on the subject of the Sierra Nevada de Santa Marta; in 1881 by F. A. A. Simons,[1] and in 1925 by A. F. R. Wollaston.[2] The mountains they described, now known to be the highest coastal range in the world, form an equilateral triangle of roughly 70 miles side, and could be accommodated fairly comfortably in the county of Yorkshire. Rearing in the immediate hinterland of the Colombian port of Santa Marta to heights of almost 19,000 feet, they fall away southward by easier gradients to the Rios Rancheria and César, which separate them from the Cordillera Central yet further south. It was perhaps natural that the first explorers of this isolated massif thought it had no connection with the main Andean system. Simons, who stressed the point, was supported by the German geologist Sievers, who related the Sierra Nevada to an old land mass of which he believed Aruba and Curacao to be remnants.[3] The latest investigations, on the other hand, are swinging strongly toward the double conclusion that the Sierra Nevada is connected synclinally with the Sierra de Perija to the east, and is a continuation of the Cordillera Central.[4]

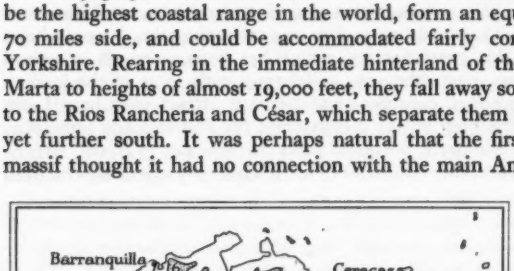


Figure 1

It was Simons, the naturalist, who first mapped these magnificent mountains, although he declared them "too barren to be really beautiful." From his base at Valledupar, he traversed the foothills on foot and horseback, and the American Cabot Expedition of 1939 followed one of his routes to the south glacier of the Pico Simón Bolívar almost exactly, in the belief that "not even the base of the highest group of peaks had ever been reached." In fact, Simons, besides pioneering the most commonly used route into the Sierra Nevada, which goes by way of San Sebastian and Mamancanaca, made an attempt to climb what he thought was the highest peak. Not being a climber, his discretion finally asserted itself. Squatting in the snow, he computed by boiling-thermometer test that he was at 17,000 feet, with another 500 feet to the summit rising above him. If the story of Alfinger's crossing of the snows of the Sierra Nevada with a bullion train be true, then Simons was the first man in 350 years to tread the high mountains again. It is fitting that the third highest peak in the Sierra Nevada should bear his name.[5]

In the autumn of 1923, Dr. and Mrs. Wollaston landed from England at the port of Santa Marta, where Bolivar died. Only 25 miles distant, the snow peaks rose

above a belt of tropical jungle, but like many people who were to come after them the Wollastons found the northern approach promising in appearance only. The coast was insect-ridden, the natives of Dibulla where they borrowed pack-animals were not hillmen, and the jungle concealed a bewildering complex of very steep valleys and ridges which reduced route-finding to frustrating guesswork. The party actually got clear of the jungle and emerged from the Macotama valley at a height of about 15,000 feet. Only half a mile away was the glacier of the easternmost of the snow peaks, and yet the Wollastons were turned back, by deteriorating weather and their demoralized Indians. They speculated that they were somewhere near the bleak *paramo* of Chirigua, the saddle by which the indefatigable Simons once crossed the range. In fact, they were less than 2 miles from it; it would have led them into the jaws of the Guatapuri valley, and thus into the heart of the great peaks.

Between the visits of Simons, the real pioneer, and the Wollastons, the Sierra Nevada attracted the occasional botanist, geologist, and zoologist. Mason made the first investigations into the shadowy Tairona culture whose roads, aqueducts, graves and settlements lie in the northern forests.[6] The age of mountaineering, however, did not begin until 1939, when a German-Colombian expedition climbed one peak on February 2, and the Cabot team climbed another on March 16. As the highest peak in the Sierra Nevada was called after Columbus as far back as 1892, and as these first ascents revealed no higher peaks in sight, it was of some moment to decide which should actually bear the Genoan's name. An Abney level carried by the North Americans suggested that their peak was the higher by 2 metres, and on the aerial survey map subsequently produced the summits are declared to be of identical height (5775 metres). The peak climbed by Cabot's party is now called Cristóbal Colón; the other, perhaps inevitably, became Simón Bolívar.[7]

It may be as well to explain at this point that the high peaks of the Sierra Nevada fall into western and eastern groups. What is otherwise an unbroken rampart stretching from Pico Simons in the west to Wollaston's snow peak in the east is severed by a deep breach between Colón and Pico Ojeda. The only serious misconception one is likely to get from the otherwise admirable and invaluable Cabot report derives from the author's habit of regarding the Colón–Bolívar group as "the main peaks" to which all other summits are subsidiary in interest as well as height. Thus the great triple ridge of which the eastern group consists, and which includes two peaks over 18,000 feet and nine over 17,000 feet, is designated misleadingly as "snow peaks east of the main ridge." The three parallel ridges of the eastern group enclose the valleys of the Guatapuri[8] and Donacui rivers which flow eastward out of the mountains before swinging south to join forces and flow into the César. A cross-section through the three ridges from north to south would reveal the extreme steepness of their north faces and the easier gradients of the south sides. As is typical in high mountains in low latitudes, the snow line is very variable, differing by thousands of feet on opposite sides of the same mountain. The southern slopes naturally carry least snow, but the north side of the northern ridge (known as the Nevaditos) and the north side of the central ridge (christened by us the Sierra Tairona [9]) bear permanent snow and glaciers. The Taironas are heavily caparisoned in ice all the year round, being protected from the trade winds by the Nevaditos, and the severest climbing in the Sierra Nevada is on their northern side. It is, indeed, of the highest significance that none of the great north precipices anywhere in the Sierra Nevada have yet been surmounted.

An expedition from the University College of the West Indies set out under my leadership in late December 1954, knowing that it had been preceded by about six parties,[10] all of which seemed to have concentrated on the western group, and to have entered the range by Simons' route through San Sebastian. It was a matter of surprise and conjecture among us that a tedious journey over the transverse ridges of the southern approach had so often been preferred to an entry from the east by way of one of the rivers flowing out of that side of the range, and we assumed there must be some compelling reason for the neglect of so obvious a route of

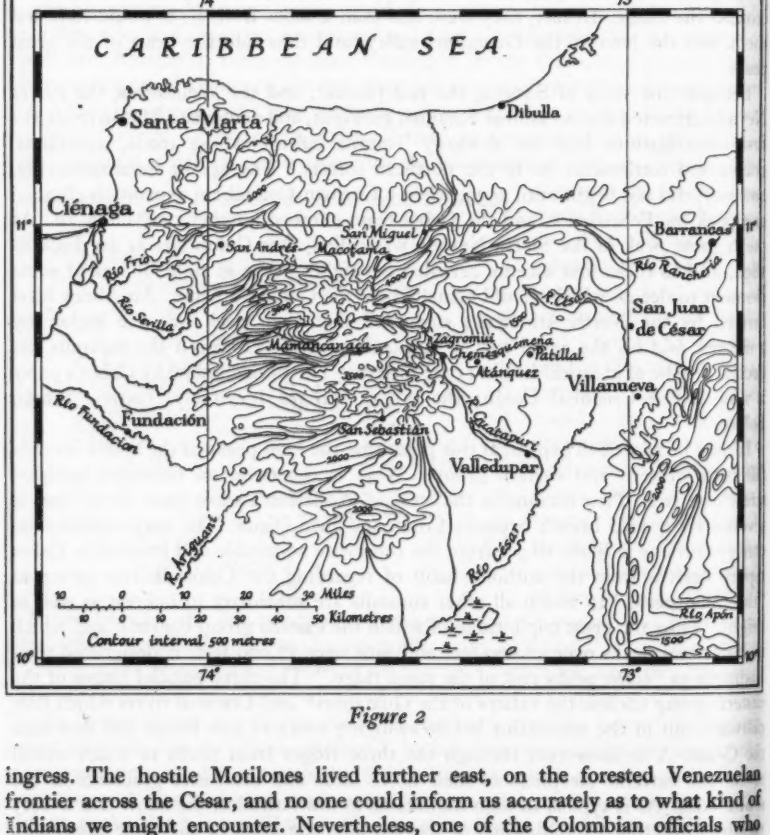


Figure 2

ingress. The hostile Motilones lived further east, on the forested Venezuelan frontier across the César, and no one could inform us accurately as to what kind of Indians we might encounter. Nevertheless, one of the Colombian officials who speeded us on our way acknowledged to a feeling that if we did not fall into a crevasse the Indians would probably eat us. My companions did not look particularly appetizing even at the outset; they would probably appear less edible than ever after a few days on the march. Positive advice to try the eastern route came from one person only and that was Señor Walter Rosenthal of Barranquilla. Rosenthal, a good friend to both our expeditions, had climbed Bolívar in 1950, and had already recommended the Donacui valley approach to a solitary climber from

Pittsburgh, Ivan Jirak. Jirak did not follow the route very far, returning after climbing a minor rock peak in the lower Donacui, but he had met Indians who had tolerated his presence. This was most encouraging, for Indians meant oxen, and oxen meant transport for our many boxes.[11]

From Jamaica, where the members of the party were working, we flew in 1954 in under two hours to Barranquilla, getting a brief glimpse just prior to landing of glistening white peaks buried in cumulus cloud far to the east. From Barranquilla, another hour's flying brought us to Valledupar, Simons' old base on the south-east corner of the massif. From the airstrip, there was a view across intervening brown ridges to the snow peaks in the north. They were about 40 miles distant. Valledupar, hot, dusty and sprawling, was described by Simons as "a very desirable residence" of 10,000 inhabitants. It has changed. Because of the high price commanded by Colombian coffee these days, Valledupar is reviving after a long sleep. It has neon signs, cheap American clothes, and iced beer, and new ranch-waggons raise the brown dust along the dirt-surfaced calleos of the town centre. Vestiges of an older regime are present in the doubtful water supply and the grim sanitation.

Valledupar makes most of its money out of coffee, cattle, and dry goods trading, and exploits the small townships and villages to the north such as Atanquez, Patillal, Villa Nueva, San Juan de César and Barrancas. This process has also implied a movement of Colombian population into what used to be purely Indian country, and a corresponding withdrawal of the Indians further into the high mountains. In Simons' day, Atanquez was purely Indian in population, and the capital of the administrative zone called the Territory of the Arhuaco Indians. The grandchildren of those Indians, reduced pathetically in numbers, now live along the Rios Donacui and Guatapuri and even there, as at Chemesquemena, they are being infiltrated by the Colombians from the plains. The Indians we encountered had vigour and pride, and were rather like bewildered children who wonder what will happen next. From our point of view, it was important that Atanquez still carried on a little trading with the Donacui Indians, and it was decided to truck to Atanquez and have our stores transported thence into the Indian country on muleback.

It is a Machiavellian precept that if only it is on a grand enough scale, iniquity is its own excuse, and the road to Atanquez, harsh and unforgiving as it contours through 40 miles of badlands, deserves to be commemorated in epic verse. The region is exceedingly hot, its flatter stretches overgrown with acacia and organ cactus. There is abundant wild life to be seen. Monkeys and very large iguanas are common, and the air is alive with the cries of parrakeets and the macaw which some people will know as the savanna blackbird. Very common too is a large red and pink parrot. Atanquez lies on the flank of a hill with an immense prospect back towards Valledupar. Its steep whitewashed streets are picturesquely squalid, and brightly coloured strings criss-cross the streets or hang along foetid lanes as though an industrious Ariadne had been at work. This is the sisal twine from which almost all Atanquieros derive a living, weaving it into bags, ropes, *mochilones* (saddle-panniers), and sandals. A Protestant missionary, Mr. Orlando Corwin, introduced us to a young man of industry called Bienvenido, the *entrepreneur* of Atanquez. Bienvenido traded with the Indians of Donacui valley, being *persona grata* with their Mama or cacique, and now agreed to provide mules and take us to the village of Zagromui. This journey takes a long and arduous day to complete, and the southern aspect of the trail as it leads across high, bare hills exposes one to the direct sun. Its great compensation is its directness and, of course, it is forest-free.

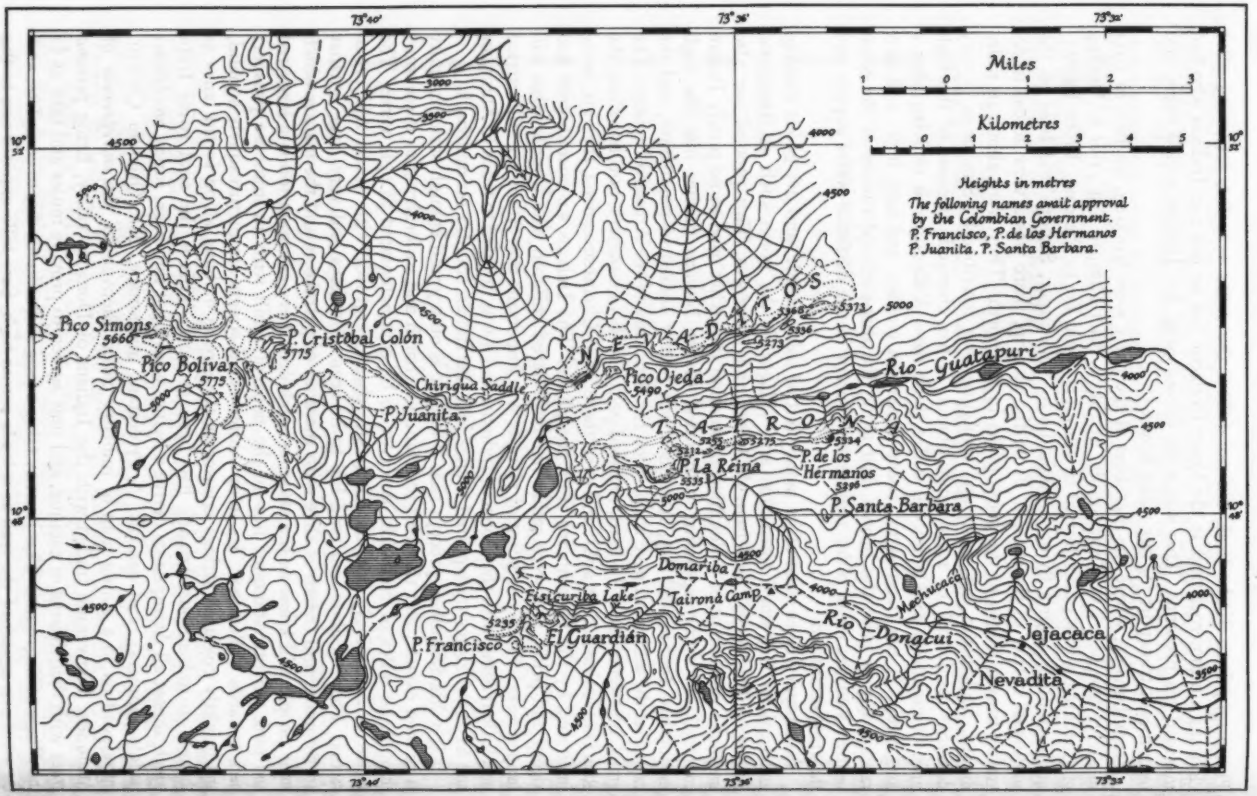

73°40'
73°38'
73°32'
10°52'
10°48'
Miles
1 0 1 2 3
Kilometres
1 0 1 2 3 4 5
Heights in metres
The following names await approval by the Colombian Government.
P. Francisco, P. de los Hermanos
P. Juanita, P. Santa Barbara.
Pico Simons 5660
P. Cristóbal Colón 5775
Pico Bolivar 5775
Chirigua Saddle
P. Juanita
Pico Ojeda 5490
NEVADOS
TATRON
5368
5373
5336
5334
5325
5375
5314
5339
5296
P. La Reina
P. de los Hermanos
P. Santa Barbara
Rio Guatapuri
Domariba
Tairona Camp
Fisicuriba Lake
5235
P. Francisco
El Guardián
Rio Donacui
Jejecace
Nevadita
4500
4000
5000
3500

Figure 2

In 1956, when we knew the route in advance and wrote ahead to Mr. Corwin to hire mules, we were in Zagromui the day after leaving Jamaica. As Zagromui is only three days' march from Base Camp at the foot of El Guardián, it is possible to leave Britain by air on Monday and be at 14,000 feet in the Sierra Nevada by Friday. This, one imagines, would have struck Simons as almost immoral.

The march to Zagromui brings a party to the Guatapuri soon after starting to climb from Atanquez. From the latter, the trail leads northward for about three hours' walk. Ahead, the first really big rock peaks peer over a wide rim. As one comes up to the rim out of the airless valley, a cool breeze is felt and only 100 yards away the Guatapuri, broad and brawling, is swinging through a right angle to flow westward to join up with the Donacui. At one's feet the great river, and at one's back the arid valley crying out for water: it is the most dramatic example of imminent river capture one could wish to see, and the Guatapuri has only to cut away another 100 yards of river embankment before it is released southward towards Atanquez. A public works department might well consider hastening the process.

Zagromui lies in the depths of a narrow valley, overwhelmed on all sides by rock mountains rising to well over 10,000 feet. The village is entered by a lych-gate, and its stone houses, with their conical thatches, lie among bright green rectangles of sugar, plantain and coca cultivation. Perhaps a hundred people live here, ruled by the masterful old cacique, Juan Batista Duani Biyafaña. Besides their own language, which has but the vaguest connections with Chibchan, some of the villagers have Spanish, which they speak with a greater purity than one expects to hear in South America. These people called themselves Aventiqua and do not accept the comprehensive term Arhuaco, which they apply to one of the other tribes of the massif.[12] Nor does the name Tairona have any deeper meaning for them, and when I questioned them on some rock-carvings of a distinctly Tairona type, the most intelligent man in the village could only offer the explanation, "antediluvio." Nevertheless, the Aventiqua have glimmerings of information which are distinctly disconcerting, and when I explained we were from an island in the sea called Jamaica it was extraordinary to hear the name repeated Xamayca, as an Arawak of the sixteenth century would have pronounced it.

To generalize about the Indians therefore seems to be inadvisable. We are dealing with at least a dozen tribes, some of them speaking distinct languages incomprehensible to the others. A good instance occurs in Zagromui, where a few Kogi families are living. They have come from the north-west, where Cabot found the "Arhuaco of San Andres." Actually, the Arhuaco live mostly in San Sebastian, and San Andres is a Kogi village. The Kogi seem to be migrating to other parts of the massif, merging with communities which will take them. The Aventiqua were not much struck with their immigrants, regarding them as slothful, and different tongues limited their intercourse. The Aventiqua, then, ought to be studied as a distinct people, with linguistic, personal and social characteristics to mark them off from other tribes of the region. They seem to be the most vigorous and intelligent tribe of all. This rather suggests that the Tairona ruled over a confederacy rather than a homogeneous race or people. With the withdrawal of the Tairona discipline the confederacy may have broken up, and uniformities of dress, social convention and religious outlook started to crumble. Today, the Kogi wear pointed caps and the Aventiqua domed ones; Wollaston's Indians had abandoned hats entirely. The single large hut in every Sierra Nevada village in which the men live communally seems to have far less ritualistic importance in Zagromui than it possesses in other villages. Above San Miguel on the north side Wollaston found

religious festivals, holy men, feather masks and a sacrificial stone, and a men's hut or *cansamaria* (from casa Maria, church of Mary?), decorated with pottery; in Zagromui the *cansamaria* is more like a men's club, where they gossip and chew coca. Jirak claims to have slept overnight in it on his way to the peak he christened "Mount Pittsburgh."

From Zagromui, the Donacui valley leads directly westward to the saddle between El Guardián, perhaps the most lovely peak in Colombia, and La Reina. The southern side of the valley is overhung by the massive and almost unbroken precipices which culminate in El Guardián, while to the traveller's right (north), the white summits of the Tairona ridge are rather more distant. The valley rises in a series of glacier-cut basins, and the first slopes to be encountered after clearing the forest above Zagromui are of boulder clay and look like the remnants of the terminal moraine which once filled the valley. Further up, there are erratics, lake-flows, and much morainic material. These evidences are obviously to be related to the Quaternary ice age and not to more recent fluctuation, though there is evidence enough of this too.

Rock relations in this part of the Sierra Nevada suggest three roughly concentric formations, and if observations on other flanks show a similar pattern one might think of the massif as a dome, eroded to reveal its inner formations. On the outside are sedimentary formations of at least Secondary age, with great thicknesses of igneous sills and lava flows. These lavas seem to have no connection with the subsequent Tertiary folding; they are of low dip and coincide generally with the "badlands" scenery between Atanquez and Zagromui. The middle formation was now on our left as we entered the upper Donacui, and consists of metamorphic rocks, highly folded in the manner of Alpine fold ranges. These rocks appear to have included both sedimentary and igneous groups, and result in a varied scenery which could be described as sub-Alpine. There was a magnificent syncline of such rocks in the great 5000-foot wall to the south of our Tairona camp. Notestein thinks these rocks are of Palaeolithic age. The innermost part of the Sierra Nevada is the granite batholith of which the highest peaks are carved. The granite is in pink and grey varieties, the "Pico de los Hermanos" in the Taironas being of the former, and the "Pico Francisco," on the west ridge of El Guardián, being of the latter. Everywhere, the granite is penetrated by great dykes, some of basalt and some of granitic, notably hornblende, type, but inclusions of other rocks are common. We would not insist on this arrangement of formations without corroborative evidence, and one of the plunging south ridges of La Reina, a mountain we thought to be wholly in the granite, shows very clearly a recumbent fold of very dark rock. There are possibly nappes here, and only when they are charted will the real relationships become clearer.

Turning to our activities among the high peaks, we walked by way of Donacui in both 1954 and 1957, taking rather longer on the first occasion because of general unfamiliarity with the terrain, and sickness which we blamed on Atanquez water. In 1956, however, we had Christmas dinner in Jamaica and spent New Year's Day, 1957, at Base Camp. On each occasion the Indians provided about a dozen oxen to carry the expedition stores, coming back later to bring us down from Base Camp again. Their familiarity with the route was apparent from their descriptions of places we would presently reach. The first night stop was at 7800 feet (2380 m.) by a bridge over the river. This place they called Nevadita. Then, passing through the high village of Jejacaca, which the Aventiqua seasonally inhabit, the trail opens out onto the *paramo* called Mechucaca. Hereafter, the valley becomes extremely

narrow and rocky, and height is gained quickly to the lake known as Domariba (12,300 feet or 3750 m.). This is an excellent camp site, for although the scenery is austere in the extreme, the frailejon (*espeletia glossophylla*) grows in profusion among the boulders.[13] So do many flowers, including a lupin, the alpine rose (*Befaria glauca*), and a stemless aster. Unlike the equally large lake 2 miles higher up the valley called Eisicuriba, Domariba appears on the Cabot map. Eisicuriba lake is beneath a hanging glacier on El Guardián and lies in a deep basin, over whose western lip the snow peaks appear dramatically and without warning. In effect, one emerges from Donacui onto an irregular saucer, littered with lakes and bounded by the peaks on all sides. The lakes, which are glacier fed, drain south-westward into the Rio Cataca, and the Indians sometimes follow this route down to Mamancanaca. The high peaks themselves are referred to by the Indians as Chumedua, the Abode of Death, and one of the most inaccessible lakes is called the Mother of the World. It is the ultimate resting place of the Indian spirits.

In 1954, Base Camp was established by a lake under the north glacier of El Guardián, at a height of 13,600 feet (4145 m.). The Bolívar–Colón group lay beyond the lake to the north-west, Ojeda in the north, and La Reina to the north-east. El Guardián towered above the tents, impressive under all conditions, a glittering wedge of banded rock and ice at sunrise, and a grey presence withdrawn among the stars at night. For a few days *soroche* took its toll, and all except Jean Kirsopp suffered from headaches, vomiting, loss of appetite and a profound lethargy. Watching her climbing on a nearby buttress, I wondered if we would ever recover. Waterlow and Hugh-Jones felt better first, but by undertaking a strenuous reconnaissance on El Guardián before they were fully acclimatized, had quite serious relapses. After a long day of examination of the west ridge, from which they had a vast view to the south, they were turned back by a series of rock steps which sweep up to the white triangle of the summit. Jean Kirsopp and I carried out a second reconnaissance, and thought four people, heavily laden, might put two of their number in a high bivouac on the mountain, but as no one was in top condition yet it was decided to attempt the easier-looking Ojeda first. Ojeda was climbed by the south side, after a bivouac at 16,300 feet (4970 m.) on its west flank. A cairn on the summit, built by the Petzoldt-Cowles party in 1941 on the first ascent, and presumably enlarged by Marmillod in 1943, was made yet bigger. Across the north lay the dark band of the Caribbean sea; to the east the deep Guatapuri valley was enclosed between the Nevaditos and the north precipices of the Tairona summits. The ascent of Ojeda presents no major problems though it is rather steep. The view down the north face of the mountain suggests that here is one of the *grandes courses* of the Colombian Andes. On the return to camp Hugh-Jones had a further bout of sickness, and as Jean Kirsopp and I were the only persons not occupied on the high-altitude physiological work undertaken by the doctors of the party, we climbed together for a day or two, naming a peak we climbed between Colón and Ojeda, "Pico Juanita."

In the last days of the 1954 expedition—we had ten days at or above Base Camp—Bunjé and Waterlow were turned back by deteriorating weather on a bold rock-and-ice peak west of La Reina. Hugh-Jones, wishing to include one of the western peaks in our itinerary and making the most of improved health, went off alone with a heavy rucksack and returned two days later having climbed Bolívar's south peak. It was a great effort for one never completely fit. On the same day as his ascent, I set off early in the morning in an attempt to get up and down El Guardián in a day. Fully acclimatized, I was able to make good time, reaching the top by two

in the afternoon. The upper parts of the west ridge, described by Grière as "quelques beaux passages," required extreme care because of their looseness. I think this is the fourth ascent of El Guardián, and the first solo.

It seems important to confess that this 1954 expedition was not, and indeed could not be, very specific in its aims, if just to emphasize that the 1957 expedition was. The medical programme must be exempted from this generalization to some degree, but otherwise we climbed what we could in the time available without knowing with any exactitude what had already been done. Our most important discovery was the superiority of the Donacui route into the mountains. At the same time, it did seem that the eastern group of peaks was deserving of more attention, and as seen from the summit of Ojeda they certainly looked more exciting than the western group. Thus the 1957 expedition took shape, its intentions being to climb and map the eastern group, and to carry further the physiological programme begun in 1954. The expedition was helped into being by many kindly midwives, notably the Mount Everest Foundation, the Royal Geographical Society and the U.S.A.A.F.

Of the 1954 party, Waterlow, Bunjé and I went again on the 1957 expedition, and were joined by Major Robert Allen of the R.A.O.C., Frank Cunningham and Ainsworth Scott. Rosenthal was prevented from coming at the last minute and Gerald Connolly, another member, caught glandular fever in Jamaica. The party of six travelled by the 1954 route, and enjoyed the same excellent weather, though there was rather more cloud this time. Our liberality on our return march through Zagromui in 1954 paid handsome dividends and the village oxen can now carry twice their original loads for the original price. Once again we were struck by the friendliness and honesty of these people as we watched them perambulating through our many boxes, swinging a speculative ice axe, but always replacing things with care. The same patients presented themselves to the doctors with the same complaints, and we were all very good friends. As before, we watched on many occasions the fascinating ritual of taking coca, in which a few leaves from a *muchilla* (coca bag) are chewed with powdered sea-shell extracted from a *poporo* or gourd with a saliva-wet stick. We even camped in one of the coca groves—a compliment indeed.

The first, two-week, phase of the expedition was at or above the old Base Camp, where Waterlow and Bunjé established a laboratory to explore an aspect of high-altitude physiology that has been rather neglected in recent years. They worked on the hypothesis that the alkalosis caused by over-breathing at altitude might lead to a loss of potassium from the body and that this might have some relation to the symptoms of *soroche* or mountain-sickness. To test this, measurements of the intake and output of potassium, sodium and nitrogen were made throughout the expedition. It was an exacting, and at times an unpleasant project, and the rest of us admired exceedingly as the doctors extracted stomach-juices from their own interiors and blood from one another. It may be of some significance that only the new members got *soroche* this year.

As cartographer, Frank Cunningham began his survey from the summit of Ojeda, the climb again requiring a bivouac on the mountain. He, Waterlow and Allen reached the top at midday, and although a strong wind made it difficult to keep the theodolite levelled, a detailed round of angles was taken of the summits round the Guatapuri basin. On subsequent days, cloud blowing up out of Donacui hindered the survey work, and attempts to reach the survey stations before the clouds arrived were not always successful. This was the more unfortunate as the intention to go along the north side of the Nevaditos, and to survey from their ridges at points respectively 2 and 4 miles east of Ojeda, had to be abandoned because of the diffi-

culty of carrying sufficient tents and equipment through the breach between Ojeda and "Juanita." The real problem was a shortage of porters, for with the doctors once engaged on their project it became increasingly difficult for them to take days off to help the rest of us. Scott was virtually *hors de combat* during this phase, Frank Cunningham was not completely acclimatized, and only Allen and I were entirely fit. But we were not reliable surveyors.

The second phase of the expedition was based on Tairona camp, at 9200 feet (2800 m.) in the Donacui valley below Domariba. The doctors stayed at Base and had much colder nights than we experienced lower down. Opposite the new camp, a wide amphitheatre leads onto the knees of the Tairona peaks, and occasional bivouacs on the amphitheatre hastened the survey from the peaks. Day temperatures always allowed climbing in shirt-sleeves, the average between ten in the morning and three in the afternoon being in the seventies. By six in the evening it was usually only slightly above freezing at Tairona, and the lowest temperature we ever recorded at any height was 22 degrees below freezing. Surveying on the exposed ridges had its trials, but also the compensation of magnificent scenery, and it was always possible to move off the ridge and warm up again in the sunshine of the south side. Probably the best night's sleep enjoyed by any of us on either expedition was had by Bunjé, Frank Cunningham and I at 16,000 feet on the amphitheatre. Sharing a Meade tent, we had three hours sunshine more than the tents visible below at Tairona, and at night we escaped the insidious Donacui breeze which coats the tents with frost. In the morning, it was possible to be on the ridge again in an hour or so.

When Waterlow and Bunjé joined us at Tairona again, and with medical and survey work well in hand, it was possible to do a little climbing for its own sake. The party climbed a dominant rock peak above the camp, with commanding views across the great ruin of the east couloirs of La Reina, naming it "Pico Santa Barbara" after the patron saint of Bob Allen's regiment. The final climb was of one of the many Tairona summits, by way of its long, sun-baked south ridge. It was a great delight to escape from the theodolite, and move unencumbered on the slabs and flakes of pink granite, and again we marvelled at a view we had seen so often. The Sierra de Perija lay far to the east, intensely blue. The prospect down into Guatapuri was breath-taking, the slabs racing down to bend over into space. Beyond, the distant valley floor was marked by the flash of the Guatapuri making its way from the glaciers of La Reina through emerald green lakes towards the east. This peak, climbed by Frank Cunningham and myself, was named "Pico de los Hermanos."

Much remains to be done in the Sierra Nevada in many fields of investigation. Besides further climbing and mapping, linguistic work among the Indians, and the answering of many insistent questions of geology, there is the intriguing subject of glacier recession. Below the present glacier snouts there are lobate moraines demarcating the former snout positions. It is possible to argue in favour of recent recession simply from the absence of soil or vegetation within the moraines, but people who remember Loch Coruisk or the Grimsel might reject this as complete proof. What seems to be much more convincing evidence is the colour of the slabs enclosed by the lobate moraines, invariably bright and clean. Would not the most effective way of studying this question be to conduct an aerial survey with colour film? Finally, for downright materialists not interested in any of these schemes, there is gold near Base Camp and an old Spanish silver mine on the flank of Simón Bolívar.

REFERENCES

[1] Simons, F. A. A., "Notes on the Topography of the Sierra Nevada of Santa Marta, U.S. of Colombia," *Proc. Royal Geog. Soc.*, 1 (1879), p. 689; "On the Sierra Nevada de Santa Marta and its watershed," *Proc. Royal Geog. Soc.*, 3 (1881), p. 705.

[2] Wollaston, A. F. R., "The Sierra Nevada de Santa Marta, Colombia," *Geogr. J.* 66 (1925), p. 97.

[3] Sievers, W., "Die Sierra Nevada de Santa Marta und die Sierra de Perija," *Zeitschr. Gesell. für Erdkunde zu Berlin*, 23 (1888), p. 1. See also Schuchert, C. 'Historical Geology of the Antillean–Caribbean region,' New York and London, 1935.

[4] See Appendix II, "Geologic and Physiographic Notes," by F. B. Notestein in T. D. Cabot, "The Cabot Expedition to the Sierra Nevada de Santa Marta of Colombia," *Geog. Review*, 29, 4 (1939), p. 587.

[5] Which peak Simons attempted is uncertain, and a matter of interpreting his account. It was definitely not the mountain called after him, and I cannot see that it can have been El Guardián or a peak east of that mountain, as Cabot suggests. El Guardián itself is just over 17,000 feet, the height Simons claims to have reached. The peak which fits his account most nearly, and coincides well enough with his estimate of its height, is the unnamed top south-east of Bolívar. Seen from the south, this peak looks at least as big as Colón and Bolívar, which lurk immediately behind it. As Simons did not reach the top, he did not have the opportunity to realize the error of his opinion that he was on the highest peak in the range. In 1954, Hugh-Jones climbed the peak alone.

[6] Link, T. A., "Post-Tertiary strand-line oscillations in the Caribbean Coastal Area of Colombia, South America," *Journ. of Geology*, 35 (1927), p. 58; J. de Brettes, "Chez les indiens du nord de la Colombie," *Le tour du monde*, 4 (1898); F. C. Nicholas, "The aborigines of the province of Santa Marta, Colombia," *Am. Anthropol.*, 3 (1901), p. 606; A. G. Ruthven, "The amphibians and reptiles of the Sierra Nevada de Santa Marta, Colombia," *Univ. of Michigan Mus. of Zoology, Misc. Pubs.*, No. 8, 1922; W. E. C. Todd and M. A. Carriker, Jr., "The birds of the Santa Marta region of Colombia: a study in altitudinal distribution," *Annals Carnegie Mus.*, 14 (1922), p. 3; G. Bolinder, 'Die Indianer der tropischen Schneegebirge: Forschungen im nördlichsten Südamerika,' Stuttgart, 1925; J. A. Mason, "Coast and crest in Colombia: an example of contrast in American Indian culture," *Nat. Hist.*, 26 (1926), p. 31; and "Archaeology of Santa Marta, Colombia: The Tairona Culture," *Field Mus. of Nat. Hist. Publ.*, 304 (*Anthrop. series*, vol. 20, No. 1), Chicago, 1931.

[7] Kraus, E., "Ascenso a la Sierra Nevada de Santa Marta," *Pan*, Bogotá, No. 31, June 1939; Cabot, *op. cit.*

[8] Wood, W. A., "Mapping the Sierra Nevada de Santa Marta," *Geog. Rev.*, 31 (1941), p. 639, with map 1:100,000. The map has the Donacui marked as the Guatapuri. The true Guatapuri is in the next valley north.

[9] To the *conquistadores*, the whole massif was known as the Sierra Tairona, at least originally.

[10] The 1954 party was Miss J. Kirsopp; the doctors J. Waterlow, H. Bunjé, P. Hugh-Jones; and myself. The 1957 party was Waterlow, Bunjé, F. Cunningham, Major R. Allen, A. Scott, and myself. Previous parties to leave accounts are Kraus, *op. cit.*, Cabot, *op. cit.* (both expeditions in 1939); Petzoldt-Cowles party (1941), see E. S. Cowles, "More about the Santa Marta," *Am. Alp. Journ.*, 1942, p. 362; Marmillod party (1943), see F. Marmillod, "Die Sierra Nevada de Santa Marta (Kolumbien)," *Berge der Welt*, 3 (1948), p. 416; Grière-Kraus party (1950), see Grière, *Alpinisme*, No. 99, 1952. Rosenthal's expedition was written up in a Colombian publication, *Semana*; in Barranquilla this year, I met an engineer, H. von Martens, who made a solo attempt on El Guardián in 1955 by the west ridge, but failed. There is no published account. The Swiss party to which Cabot refers, *op. cit.*, p. 601, does not appear to have left any record. Rosenthal was informed by an Austrian who met them that they were not Swiss at all but German, that their fatality was not in a crevasse but on rock. The only survivor of the party still in Colombia lived in Bucuramanga in 1954. But see A. Gansser, "Die Berge Kolumbiens," *Berge der Welt*, 3 (1948), p. 402.

[11] Jirak, I. L., "Donachui to the Sierra Nevada de Santa Marta," *Appalachia*, No. 29, Dec. 1952, p. 181. Jirak makes the curious remark that Spanish is not spoken in Donacui, whereas many of the Indians know it. The peak he climbed is difficult to locate in a region of so many rock summits, though the waterfall he mentions is a very prominent landmark. It is, however, not at 13,000 feet as Jirak thought, but at less than 9000 feet.

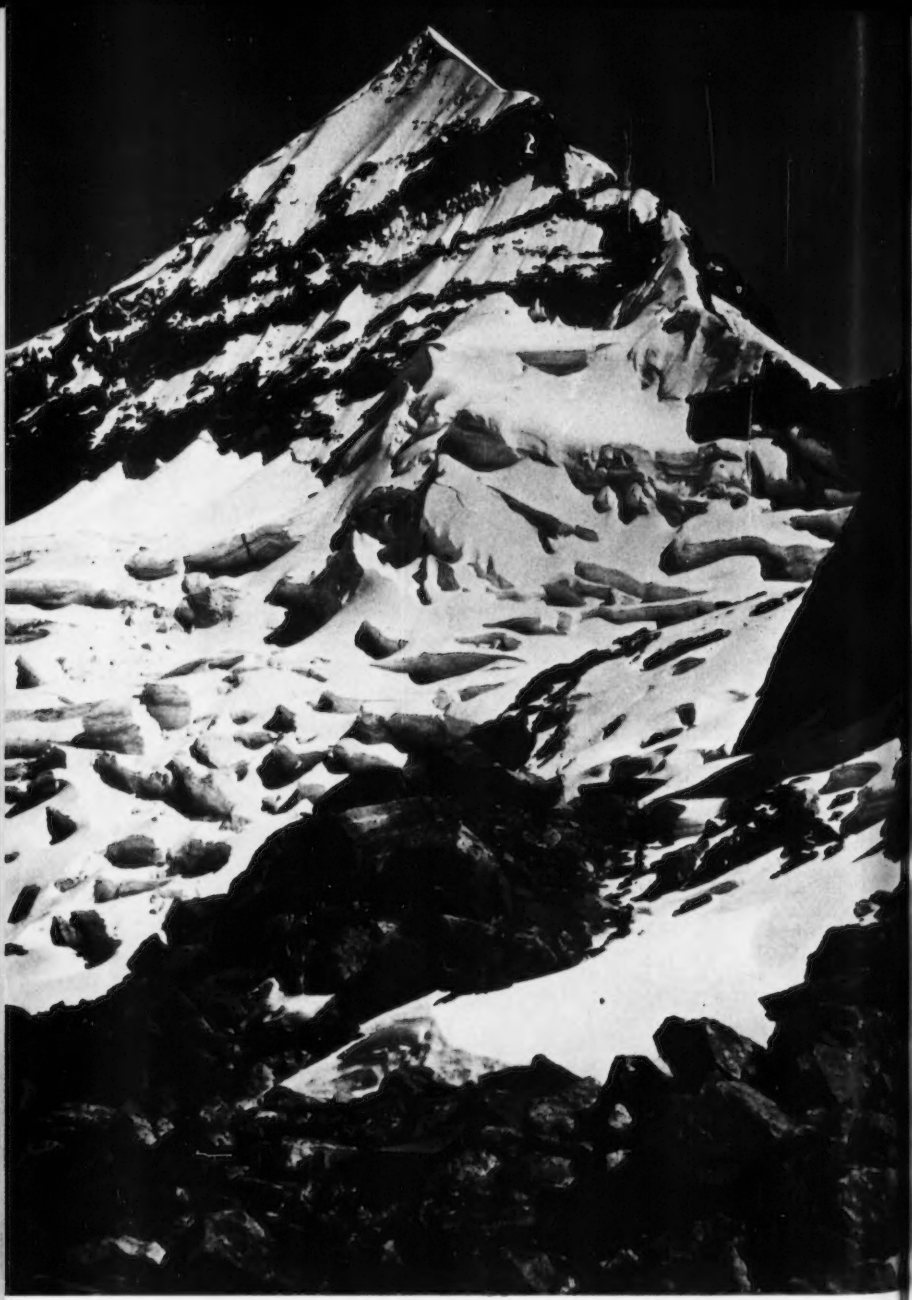
Between Atanquez and Zagromui, looking north-west

Twin summits of Bolívar and Colón (18,947 feet) from Ojeda

The Tairona peaks from the summit of Ojeda (18,010 feet)

Rock-carvings, possible Tairona origin

The Mama (Cacique) of Donacui; note his coca bag, and his attendant's coca gourd (poporo)



El Guardián (17,175 feet) climbed by the west (right) ridge

[12] The Aventiqua know of the following tribes in or near the Sierra Nevada: Kogi, Arhuaco, Guajiro, Motilones, Tupe, Tairona, Alsario, Cancua, Putumayo, Guanes, Guindio.

[13] Schultze, A., "Flammen in der Sierra Nevada de Santa Marta," *Mitt. Geogr. Gesell. in Hamburg*, 45 (1937), p. 59.

DISCUSSION

Evening Meeting, 18 March 1957

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: Dr. Allan Cunningham is by profession a lecturer in modern history at Royal Holloway College, University of London. This evening he is going to lecture to us on a geographic subject, but by recreational vocation he is a mountaineer and a scientific explorer. He has within the last few weeks returned from an expedition to the Sierra Nevada de Santa Marta, the most northerly extension of the Andes on the borders between Colombia and Venezuela, and the highest coastal mountain range in the world. This was not Dr. Cunningham's first visit to that northern spur of the Andes. In 1954 when he was on the staff of the University College of the West Indies, he made a preliminary exploration there. He is not only an exploratory mountaineer; he carried out with his companions a topographical survey and physiological investigations. The region is of particular interest to the Royal Geographical Society because in 1923 one of our most distinguished Gold Medallists, Dr. A. F. R. Wollaston, together with his wife, attempted to scale some of the highest peaks in that range.

Mr. Cunningham then read his paper

The PRESIDENT: We have as our guest this evening Brigadier Sir John Hunt who is not only President of the Alpine Club, but Chairman of the Mount Everest Foundation which made a contribution to Dr. Cunningham's mountainous adventure. I ask Sir John Hunt to add a word or two about the mountaineering hazards of Dr. Cunningham's expedition.

Brigadier Sir JOHN HUNT: I much appreciate the opportunity to wind up this evening's fascinating lecture. I am sure you, as I, have listened enthralled to Allan Cunningham's account of a part of the world which at any rate to myself, is completely unknown and I am sorely tempted to accept his challenge to tackle some of those north faces: they looked thrilling. I can find no parallel in my own experience except the barren granite mountains in the peninsula of Sinai which I know fairly well. Looking at his pictures I felt, and I am sure you will agree with me, that we were enjoying brilliant photography. As Chairman of the Mount Everest Foundation I take great pleasure in the fact that we have been able to contribute, in a very small way, to the carrying out of this expedition which is typical of an immense amount of resourceful, enterprising, courageous and skilful exploration being carried out with similar help all over the world today.

The PRESIDENT: I heartily echo Sir John's words in thanking Allan Cunningham for a delightful evening's entertainment.

THE EROSIONAL HISTORY OF THE UPPER WYE BASIN, CENTRAL WALES

R. J. RICE

THERE IS AN ever-increasing interest in the physiographic history of Highland Britain, and yet the catchment basin of the river Wye, some 1500 square miles in extent, remains from a geomorphological viewpoint largely uncharted ground. While the significance of the course followed by the trunk river and its major tributaries has often been discussed (for instance, Jones, 1951, and Lake, 1934–5), the actual denudation chronology of the Wye basin has received but little attention. The most important study is undoubtedly that of Miller who, over twenty years ago, described the entrenched meanders along the lower reaches of the river (Miller, 1935). It is the object of the present paper to elucidate the pre-glacial history of a further portion of the basin.

To this end, two independent methods of geomorphological analysis have been used. The form of the valley cross-section has been the basis of the first method, the nature of the stream long profile the basis of the second. Only when both these lines of research had yielded results was any comparison attempted. This fact can scarcely be over-emphasized in view of the criticism which has on occasions been levelled at each of the methods employed (Johnson, 1938, and Miller, 1939). To test still further the accuracy of the results obtained a similar procedure was adopted in a study of suitable tributary valleys.

Method of field investigation

Six-inch maps and a surveying aneroid were used throughout. There has been heated debate about the accuracy of aneroid surveying (for example, in discussion of the paper by George, 1942), and in order to allay as far as possible any doubts concerning the validity of the data offered in evidence, considerable precautions were taken. The nature of the features surveyed was varied in accordance with prevailing meteorological conditions, the river profiles in particular being measured during anticyclonic spells. Moreover, to reduce still further the errors which might accrue from barometric fluctuations, the survey of the Wye profile was repeated a second time and the two sets of figures averaged. The lapse of time between aneroid corrections made while surveying the Wye profile was 30 minutes, while surveying the tributary profiles about 45 minutes, and while surveying the valley-benches about 60 minutes. It is believed that these stringent precautions probably limited the errors to ± 4 feet in the case of the valley benches, $\pm$ 3 feet in the case of the tributary profiles, and ± 2 feet in the case of the Wye profile.

The physiography of the upper Wye basin

The river Wye rises on the eastern slopes of Plynlimon whence it flows for about 50 miles south-south-eastwards to Glasbury. There, at the foot of the Black Mountains escarpment rising to over 2000 feet, it turns abruptly to the north-east. It is the catchment basin above Glasbury that is hereafter referred to as the upper Wye drainage basin. Within that area three distinct physiographic provinces may be recognized (Fig. 1).

The Mynydd Eppynt.—This cuesta-form upland, some 10 miles broad and 1300–1500 feet high, extends in a north-east–south-west direction across the southern portion of the basin. Reference to a geological map indicates that it cannot be termed a cuesta *sensu stricto*. The southward dip of the Silurian and Old Red Sandstone shales and mudstones so exceeds the surface declination that the individual beds

outcrop in bands on the quasi-dip-slope. Nor does any one horizon appear responsible for the escarpment, the summit plain being bevelled across the various members of the Ludlovian succession (Straw, 1937). The form of the Mynydd Eppynt must

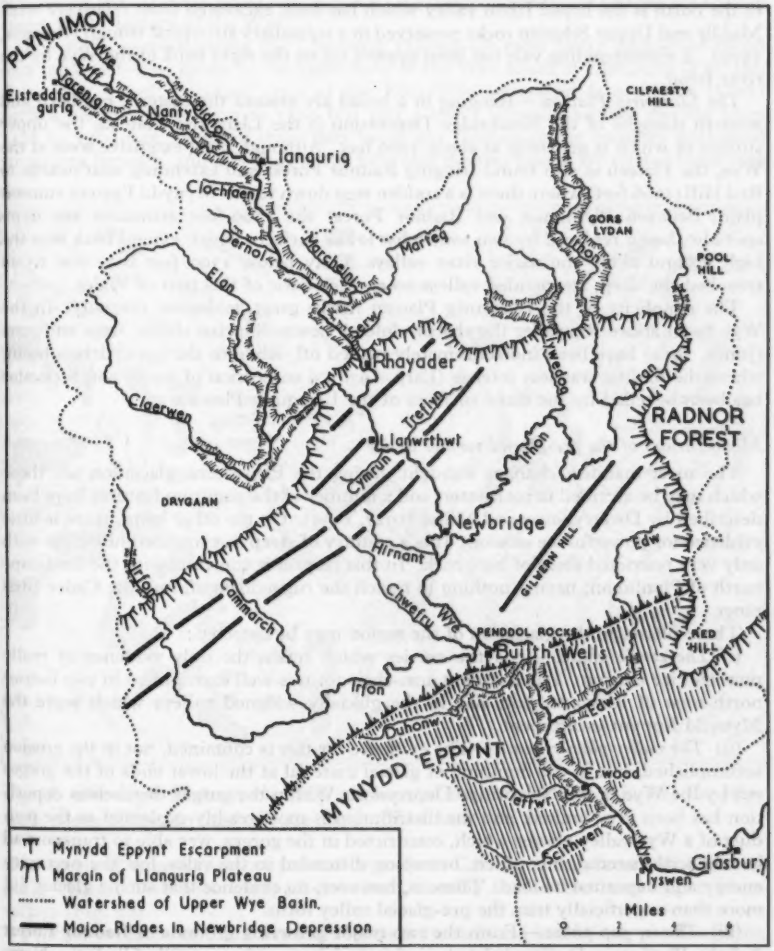


Fig. 1. Major relief features of the upper Wye basin

therefore be interpreted as the result of its erosional history rather than of the underlying geological structure.

The Newbridge Depression.—The southerly dip of the Silurian strata on the Mynydd Eppynt reflects their position on the southern limb of the Towy Anticlinorium. This structure, traversing the Newbridge Depression from south-west to north-east, brings to the surface a succession of Upper Ordovician grits and shales (Jones, 1912). On the northern limb these have been sculptured into a series of sub-parallel ridges and

valleys, but on the southern the more complex tectonics have produced correspondingly less regular relief. The dominant feature is the Gilwern Hill upland, the surface expression of a small horst in which extremely resistant dolerites are exposed (Jones, 1947, and Jones and Pugh, 1948). Between this upland and the ridge and valley zone to the north is the broad Ithon valley which has been excavated from relatively weak Middle and Upper Silurian rocks preserved in a subsidiary structural trough (Roberts, 1929). A corresponding vale has been opened up on the right bank of the Wye by the river Irfon.

The Llangurig Plateau.—Ranging in a broad arc around the eastern, northern and western margins of the Newbridge Depression is the Llangurig Plateau, the upper surface of which is generally at about 1700 feet. Although most extensive west of the Wye, the Plateau is also found fringing Radnor Forest and extending southwards to Red Hill (1666 feet) where there is a sudden step down to the Mynydd Eppynt summit plain. Between Plynlimon and Radnor Forest the 1700-foot remnants are more sporadic, being replaced by two somewhat lower surfaces which extend back into the high ground along the major river valleys. Only below 1300 feet have the rivers trenched the deep, steep-sided valleys so characteristic of this part of Wales.

The simplicity of the Llangurig Plateau masks great geological diversity. In the Wye basin above Rhayader the sharply folded Lower Silurian shales, flags and grits (Jones, 1912) have been indiscriminately planed off, while in the upper Ithon basin, where the folding was less intense (Earp, 1938), a succession of north–south cuestas has been bevelled by the three surfaces of the Llangurig Plateau.

Modifications of the pre-glacial surface by ice

The most manifest changes wrought during the Pleistocene glaciation are those which may be ascribed to meltwater, and a number of the resulting features have been described by Dwerryhouse and Miller (1927, 1930). On the other hand, there is little evidence for powerful ice erosion. It is a country of steep but rounded hillslopes with only very restricted areas of bare rock. In this respect it contrasts with the landscape north of Plynlimon, having nothing to match the ruggedness of, say, the Cader Idris range.

Three phases in the glaciation of the region may be detected:

(i) *The corrie phase.*—It is the corries which retain the only evidence of really powerful ice erosion. The resultant arm-chair form is well exemplified in two corries north-west of Rhayadar and also in the glacially widened valleys which score the Mynydd Eppynt escarpment.

(ii) *The valley glacier phase.*—The evidence for this is contained, not in the erosion accomplished, but in the dumping of glacial material at the lower ends of the gorges cut by the Wye in the Newbridge Depression. Within the gorges themselves deposition has been very limited, and the distribution is most readily explained as the product of a Wye valley glacier which, constricted in the gorges, was able to transport all its englacial material, but which, becoming distended in the vales, lost the necessary energy and deposited its load. There is, however, no evidence that such a glacier did more than superficially trim the pre-glacial valley form.

(iii) *The ice cap phase.*—From the two major gathering grounds of Radnor Forest and the Plynlimon–Drygarn plateau, ice moved into, and eventually filled, the Newbridge Depression. Overflow round the southern margin of the Depression is testified by the erratics found on the southern slopes of the Mynydd Eppynt (Howard, 1904). With amelioration of the climate there persisted in the lower Ithon and Irfon valleys a mass of stagnant ice around which overflow channels were cut at successively lower levels. The decay of this ice left a widespread veneer of boulder clay and fluvio-glacial material but nowhere does it seem to have been thick enough to prevent the rivers rapidly returning to their pre-glacial levels.

The earliest discernible stages in the denudation history

The various facets of the Llangurig Plateau form a giant physiographic stairway. Careful mapping reveals this stairway as the product of periods of fluvial stability alternating with those of rapid downcutting. These events form the earliest discernible stages in the history of the Wye.

The surfaces constituting the Llangurig Plateau are most easily distinguished on four long east–west spurs on the right bank of the Wye south of Llangurig (Fig. 2A). Below the broad 1700-foot crest of the Elan–Wye watershed is a middle (Gwy) surface sloping from 1600 to 1500 feet and a lower (Rhudd) surface sloping from 1400 to 1300 feet. None of these flats bears any relation to the complex geological structures beneath, and it is clear in the field that the two lowest are related to ancient

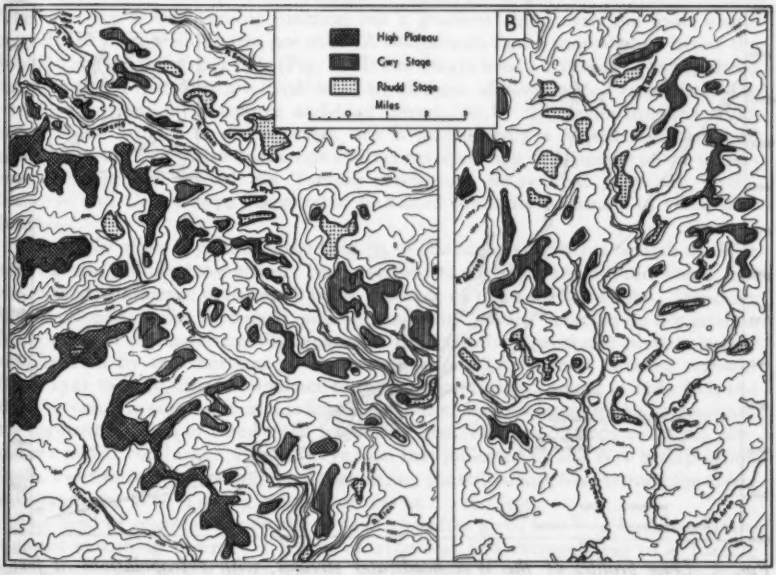


Fig. 2. The High Plateau, the Gwy surface and the Rhudd surface in (A) the Wye basin above Rhayader and (B) the upper Ithon basin

river levels of approximately 1500 and 1300 feet. Corresponding facets of the Llangurig Plateau have been mapped elsewhere, notably in the Elan and upper Ithon valleys (Fig. 2B).

Further evidence of these two river levels is to be found in the long profiles of the Wye and Tarenig (Fig. 3). The highest knickpoints on the Wye are at 1890 and 1628 feet. From the source of the river at over 2100 feet down to 1890 feet the profile is so steep and irregular as to be entirely unsuited to the fitting of a mathematical curve. The profile segment between 1890 and 1628 feet, however, conforms quite closely to a simple logarithmic form and, when allowance is made for some artificially induced meanders on the floor of an old reservoir, it may be extrapolated to 1409 feet at the confluence of the Tarenig.[1] The highest segment of the Tarenig profile is rendered useless by a thick deposit of boulder clay, but that between 1750 and 1547 feet may,

[1] All extrapolations were calculated on the basis of the formula $y=a-k\log(p-x)$ as originally used by J. F. N. Green (1934).

with certain adjustments necessitated by a sudden incision of the stream into its broad valley floor, be fitted by a logarithmic curve extrapolating to the Wye at 1413 feet. While it seems unlikely that either the Wye or Tarenig extrapolation is very accurate, there is nevertheless strong reason for supposing a former still-stand when the Wye–Tarenig confluence stood at *c.* 1400 feet. On the basis of the river gradient to be expected, this is clearly the equivalent of the 1300-foot Rhudd level at Llangurig. Although it is little more than conjecture, the highest segments of the Wye and Tarenig profiles may well correspond to the 1500-foot Gwy level at Llangurig.

Whilst the Gwy and Rhudd stages are traced with comparative ease north of Rhayader, their recognition presents many problems further south. The hills bordering the Wye near Newbridge are clearly truncated at heights related to river levels of

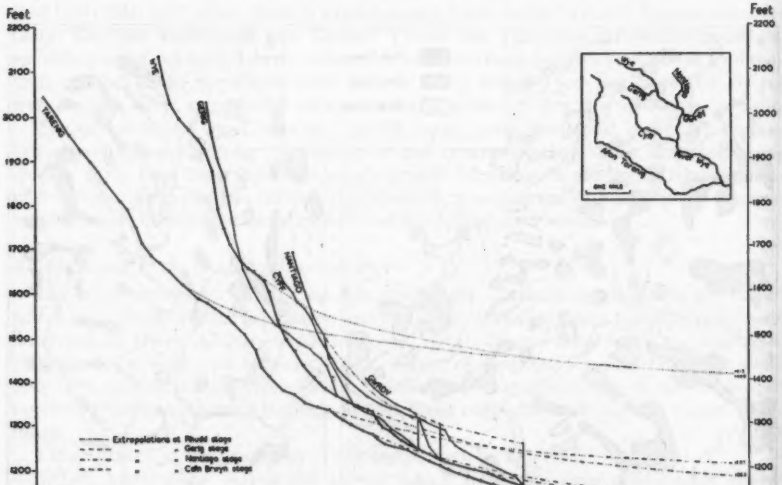


Fig. 3. Long profiles of the Wye headwater streams, with extrapolations at four main stages

c. 1350 and 1150 feet, but in the Erwood gorge below Builth Wells where the Wye traverses the Mynydd Eppynt there is little evidence of any still-stand between 1000 and 1500 feet. On the southern flanks of the Mynydd Eppynt, however, a widespread 1300-foot bevelling, easily distinguished along the Wye–Honddu watershed and in the accordant summit levels of isolated hills nearer the river, is believed to indicate a river height at Glasbury during the Gwy still-stand of *c.* 1250 feet. In the same area the Rhudd surface is also poorly developed and it is as much on the basis of probable stream gradient as on direct evidence that the Rhudd river level at Glasbury is assessed as 1050 feet. Two steps on the Black Mountains escarpment, both much influenced by structure, correspond closely to the above river levels and may form part of the Gwy and Rhudd surfaces. On the other hand there is some doubt whether, at these altitudes, the Wye followed its present course below Glasbury (Rice, 1957).

The place in the denudation chronology held by the Mynydd Eppynt summit surface is problematical. The surface might be interpreted either as the down-warped equivalent of the highest fragments of the Llangurig Plateau (the so-called High

Plateau) or alternatively as a feature slightly younger than the High Plateau. In the opinion of the present writer the conspicuous break of slope from the 1700-foot fringe round Radnor Forest down to the Eppynt summit level makes the latter hypothesis more likely, and the summit level might in fact be correlated with a rather indeterminate 1600-foot surface around Rhayader. With the evidence available at present, however, this correlation must remain purely tentative.

The Gerig, Nantiago and Cefn Brwyn stages

The rejuvenation which terminated the comparatively long Rhudd still-stand ushered in a series of shorter still-stands. Of these the Gerig, Nantiago and Cefn Brwyn have been arbitrarily divided from their successors because the knickpoint initiated at the end of each has migrated beyond the Wye–Tarenig confluence. This has an important effect upon the evidence by which the stages may be reconstructed. The Wye above the Tarenig junction has a gradient along even the most gentle stretches of more than 80 feet per mile. A comparable figure immediately below the junction is only 26 feet per mile (Fig. 8). It has always been a criticism of extrapolated stream profiles that they are invalidated by changes of slope which result from the varying contribution of volume and load introduced by tributaries into the trunk river (Miller, 1939). In certain cases this is undoubtedly a cogent argument and clearly it would be unwise to attempt a direct extrapolation of segments of the uppermost Wye profile beyond the Tarenig confluence. Below that point the Gerig, Nantiago and Cefn Brwyn stages must be traced primarily be means of valley-side benches.

The profiles of the Wye headwaters (Fig. 3).—The highest segments of both the Wye and Tarenig profiles have already been ascribed to the Gwy and Rhudd stages, but above their confluence each brook bears evidence of three further stages. These are best developed on the Wye itself, and although the "graded" reaches do not attain a high degree of regularity any discrepancy in the fit of the logarithmic curve is largely compensated by the shortness of the extrapolation. The highest concave segment (from 1541 to 1330 feet) extrapolates to the junction of the Tarenig at 1183 feet, but there is reason to suppose that this figure is too low. Extrapolation of the corresponding segment on each of three small tributaries, the Nantiago, Gwrdy and Cyff, produces a higher confluence with the Wye than that indicated by the Wye extrapolation itself. For this reason it is suggested that during the still-stand, here termed the Gerig still-stand, the Wye–Tarenig confluence was at *c.* 1200 feet.

The head of rejuvenation on the Wye at 1330 feet gives way to a further concave segment extending down to a height of 1192 feet and extrapolating to a Tarenig junction of 1118 feet. This is termed the Nantiago stage. The Cefn Brwyn stage is represented by that section of the profile between 1192 and 1077 feet. This reach of the Wye is particularly irregular and the fit of the logarithmic curve is not good. To balance this, however, the figure of 1051 feet for the Tarenig junction is based upon an extrapolation of only a little over half a mile.

Examination of the Tarenig profile reveals that again three post-Rhudd concave segments are present. The actual form of the segments is complicated by the outcrop of a number of massive grit bands and the field evidence is certainly more convincing than that of the plotted profile. The use in each case of that logarithmic curve which deviates least from the measured thalweg produces heights for the Wye–Tarenig confluence remarkably similar to those derived from the Wye. Whilst no great accuracy for the analysis of either the Wye or the Tarenig profile can be claimed, there is undoubted evidence for three still-stands when the confluence stood at *c.* 1200, *c.* 1120 and *c.* 1050 feet.

The valley-side benches.—The incision of the Wye above Rhayader into the Rhudd surface has left but fragmentary traces of later periods of still-stand. The Gerig is the most fully represented, being evidenced above Llangurig by four prominent benches on the spurs in the acute angle between the Wye and its tributaries. These,

and a number of smaller features between Llangurig and Rhayader, indicate a fall in the Gerig river level to 1025 feet at Rhayader.

At this point mention may be made of a series of benches above those attributed to the Gerig stage, yet below the level of the Rhudd surface. This is the first indication of a dichotomy of the Gerig stage fully substantiated by the disposition of benches further downstream. Whilst this higher Gerig sub-stage is apparently not represented on the Wye profile it is possibly found on the thalweg of the Gerig itself (Fig. 3). Benches belonging to the Nantiago and Cefn Brwyn stages are so few that the suggested relationship of segments of the Wye profile to numerous benches downstream from Rhayader is based, firstly, on the river gradient to be expected, and, secondly, on the evidence, to be described below, afforded by the tributary streams.

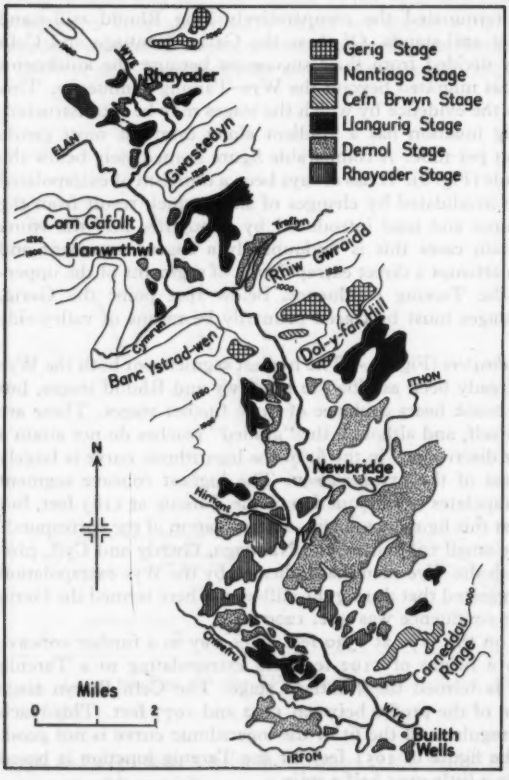


Fig. 4. Extent of major surfaces in the Newbridge Depression

In the Newbridge Depression the soft Upper Ordovician and Lower Silurian shales have been so quickly worn down after each fall in river level that the relatively early Gerig, Nantiago and Cefn Brwyn surfaces are now restricted to the flanks of the higher mudstone hills (Fig. 4). The Gerig surface is again the most extensive; the two substages are easily identified between Rhayader and Newbridge, but there is then a section downstream as far as Builth which is necessarily devoid of evidence owing to the absence of high ground near the river. Similarly, conspicuous Nantiago benches are found immediately below Rhayader and indicate a former still-stand at that town of *c.* 925 feet, but there is again no evidence to bridge the gap between Newbridge and Builth. Only at the level of the Cefn Brwyn stage is the gap bridged, for on the western end of the Carneddau Range is an irregular surface at between 750 and 800 feet which apparently truncates a number of dolerite intrusions.

In the Erwood Gorge, benches become extremely numerous. In Fig. 5 the division of the benches into three main groups is based entirely upon field observation, and it was only later that each group was correlated with a concave segment on the Wye profile. All benches of significant extent have been plotted, each being represented by one quadrilateral, the height of which is proportional to the height range of the

bench, and the length to the greatest width of the bench. By employing this method of plotting (a modification of that used by Brown, 1952) it was hoped to reduce to minimum size the representation of the least significant features, that is, the narrow valley-side shelves with steep riverward gradient. The Gerig surface is again the most extensive, twenty-eight remnants having been mapped along an 8-mile section of the gorge. Careful mapping discloses the subdivision already noted upstream, and in a number of cases remnants of the two substages occur one above the other and separated by a quite distinct bluff. Such evidence must be the real basis for subdivision, for it vitiates the possibility of an unusually wide scatter of benches related to one river level. It was concluded, in the field, that at the main Gerig stage the Wye fell from 910 feet at Builth to 840 feet at Glasbury; the corresponding figures for the substage were 980 and 910 feet. The abundance of the evidence permits a precise estimate of the river levels during the Nantiago and Cefn Brwyn stages, and it

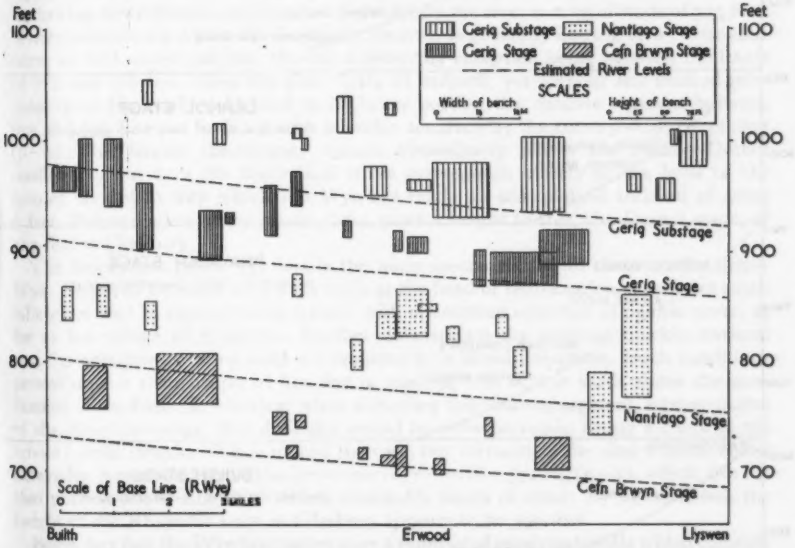


Fig. 5. Height-range diagram of the higher valley-benches in the Erwood Gorge

appears that during the former the height of the river declined from 820 feet at Builth to 750 at Glasbury, and during the latter from 750 to 680 feet. In this way it may be demonstrated that concave segments on the uppermost Wye profile are related to ancient river levels at Glasbury of 840, 750 and 680 feet.

The Llangurig, Dernol, Rhayader and Builth stages

These are the most fully "documented" of the pre-glacial stages, and again it is the coincidence of the results from the profile and valley bench studies which must be stressed.

The long profile of the upper Wye.—In Figures 6 and 8 the profile is represented in two ways. In Figure 6 a large vertical exaggeration has been used so that the deviation between surveyed points and theoretical curve is measurable: with the same base scale and no vertical exaggeration the greatest deviation would be less than one-thousandth of an inch. In Figure 8 the minor irregularities have been ignored and the knickpoints accorded their true importance.

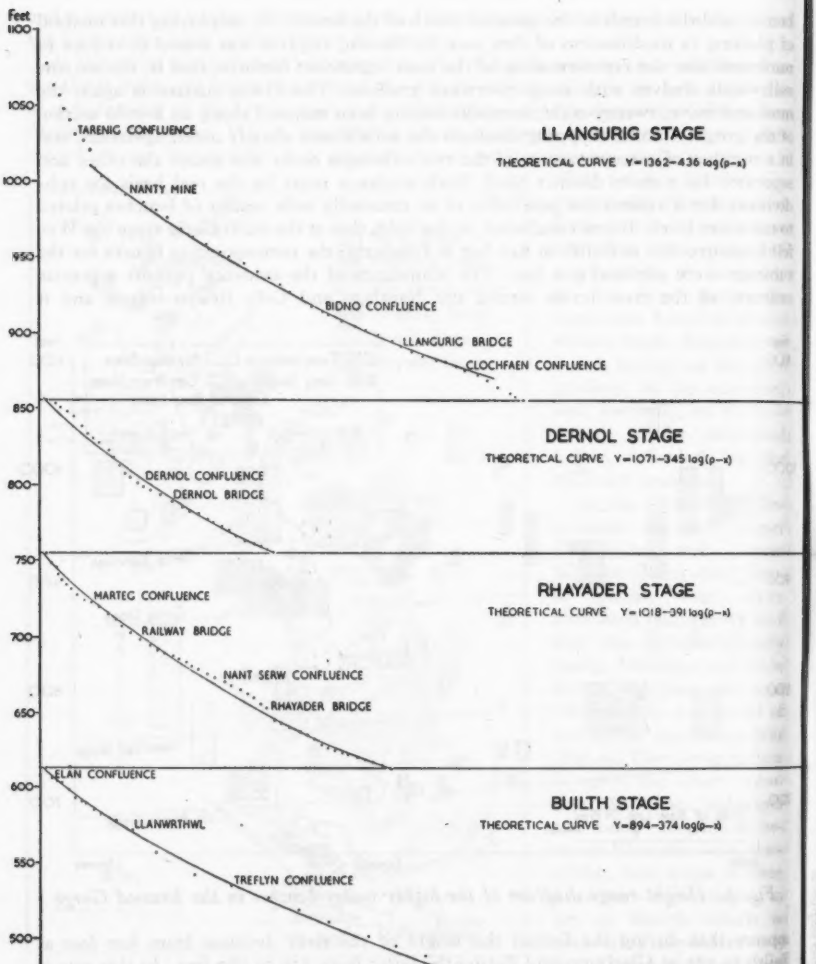


Fig. 6. Concave segments of the upper Wye profile. Dots represent measured heights, continuous lines the theoretical curves

A short distance below the Tarenig confluence the Wye valley broadens rapidly and the river commences to meander across a wide floodplain cut from the boulder clay deposit of a mass of stagnant ice. It is readily demonstrable, however, that the river has returned to its pre-glacial level since in many instances the cover of pebbles on

the river bed is so thin as to reveal the underlying bedrock. Such conditions persist until, a mile below Llangurig and at a height of 872 feet, a narrowing of the valley and an increase in the river gradient mark the upper limit of a further rejuvenation. The segment of the Wye profile between 1008 and 872 feet is of regular concave form and is fitted with very little discrepancy by the curve $y=1362-436 \log (p-x)$. Mathematical extrapolation for this, the Llangurig stage, gives a former river level at Glasbury of 607 feet.

After half a mile during which the Wye flows rapidly over a bed of boulders and cobbles resting on a bedrock basement the gradient slackens and a floodplain 180 yards broad has been eroded. The floodplain is, however, shortlived for at 855 feet O.D. the river cascades down another series of rapids. Further reference to this short "graded" reach is made in the description of the valley benches.

The rapids which commence at a height of 855 feet extend almost to the confluence of the Nant-y-Dernol. At that point a broad floodplain begins which, although narrowing downstream, stretches to a point where the river is at an altitude of 755 feet. Where meandering across the floodplain the river is generally flowing on a continuous cover of well-sorted pebbles, the one noteworthy exception being between the levels of 777 and 766 feet where the river flows on bedrock, yet without any marked irregularity in the profile. At least in its lower portion the concave segment between 855 and 755 feet can be fitted with tolerable accuracy by the curve $y=1071-345 \log (p-x)$. The largest discrepancy occurs immediately above the Nant-y-Dernol confluence, but here the theoretical curve corresponds closely to the level of the former floodplain into which the Wye has made an unexplained incision of some 6 feet. Extrapolation of the above curve gives a height to this, the Dernol stage, of 505 feet at Glasbury.

The knickpoint below 755 feet is the most spectacular of all those on the upper Wye. Enclosed between steep rock walls at the head of rejuvenation, a series of small falls gives way to rapids which extend, with alternating stretches of pebble cover, as far as the village of Rhayader. Further downstream the gradient quickly slackens and the precipitous valley sides are replaced by a broad floodplain. Such conditions persist until a river height of 612 feet is reached, that is, 150 yards above the confluence of the Elan. It was clear when surveying this thalweg segment, representative of the Rhayader stage, that difficulty would be encountered in fitting a curve to the whole 6-mile length. This is indeed the case, but fortunately the vital 2 miles below Rhayader correspond very closely to a curve, $y=1018-391 \log (p-x)$, which also fits that portion above Rhayader within reasonable limits of error. By extrapolation the height of the Rhayader stage at Glasbury appears to be 390 feet.

Below 612 feet the Wye first passes over a number of small waterfalls which coincide with conglomerate bands and then flows for 2 miles on mudstone outcrops littered with large boulders. Only below a river height of *c.* 535 feet are a gentler gradient and associated floodplain to be found. The floodplain, backed by boulder clay bluffs, is continuous as far as Penddol Rocks, but there the river, after flowing more and more sluggishly, suddenly cascades over the resistant dolerites outcropping on its bed. This abrupt increase in gradient at 421 feet must be considered a retarded rejuvenation head since corresponding knickpoints are present on all those tributaries joining the Wye between Builth and Glasbury. The profile segment between 612 and 421 feet, 12·57 miles long and representing the Builth stage, does not conform closely to a logarithmic curve, and a discrepancy of 7 feet is inevitable. However, that curve which gives the best overall fit, $y=894-374 \log (p-x)$, provides a height of 316 feet for the Builth stage at Glasbury.

The profile of the Wye in the Erwood Gorge is very irregular and is outside the concern of this paper, but it remains to see how the valley-bench evidence compares with the above extrapolations.

The valley-side benches.—Above Rhayader only the Llangurig stage is clearly represented by valley benches. The most prominent benches occur at the confluences of

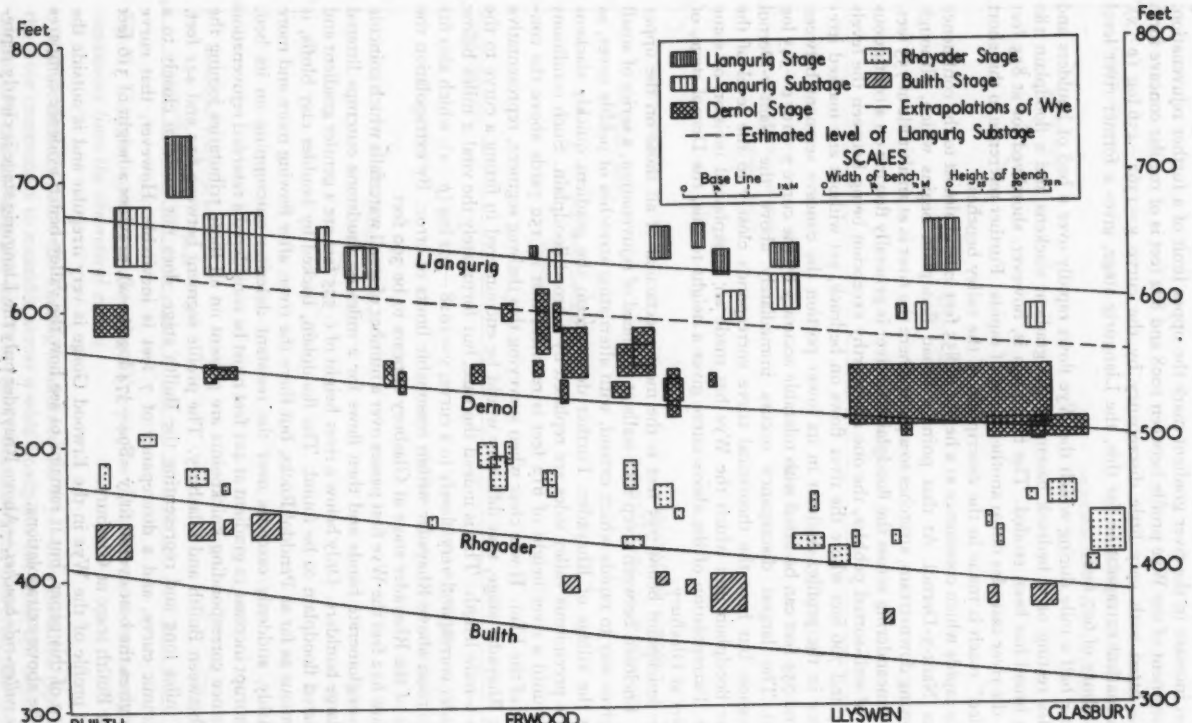


Fig. 7. A height-range diagram of the lower valley-benches in the Erwood Gorge. Curves obtained by extrapolating segments of the Wye profile have been superimposed

the Marteg and Serw valleys, and in both cases there is an almost exact coincidence of the leading edge with the former river level as calculated by extrapolation. At the junction of the Serw valley there is, in addition, a delicately chiselled bench some 35 feet lower which it seems reasonable to correlate with the short segment of the Wye profile between 872 and 855 feet. This is the first instance of a duality in the Llangurig surface noted in many areas further downstream.

Rarely in the Newbridge Depression do the leading edges of the Llangurig, Dernol and Rhayader surfaces approach very close to the Wye (Fig. 4) but whenever they do they manifestly confirm the accuracy of the extrapolations. Three examples must suffice. The Llangurig bench opposite the mouth of the Cymrun has its leading edge at 740 feet, compared with a river level of 738 feet calculated by extrapolation. It may be noted that in this locality the duality of the Llangurig stage is again apparent. Remnants of the Dernol surface, which is so extensive in the Newbridge Depression as to merit Wooldridge's term "Hemi-plain" (Wooldridge, 1928, p. 2), form the lips of a narrow gorge at Rhayader; the lips, less than 100 yards apart, are at exactly 700 feet, the extrapolated river height at 696 feet. Finally the leading edge of the Rhayader surface close to the Ithon confluence is once more less than 10 feet above the calculated river level.

The distribution of the numerous valley-side benches in the Erwood Gorge is adequately summarized in a height-range diagram (Fig. 7). The correspondence with the extrapolated logarithmic curves is so remarkable that it must be reiterated that the shading of the benches in groups is based solely upon field observation. The height of the extrapolated curve at the Llangurig stage is exactly as was anticipated during the investigation of the transverse form of the gorge; it is evident from Figure 7 that the numerous and well-preserved Dernol flats testify with almost equal strength to the correctness of the second extrapolation. Any discrepancy is so slight that it may well result from weathering of the leading edges of the benches, especially as only one very small feature occurs entirely below the curve. The diagram is itself sufficiently eloquent with regard to the Rhayader stage, but it should be pointed out that in the case of the Builth stage, some of the lower members of the group may be obscured by a thick deposit of fluvio-glacial gravel.

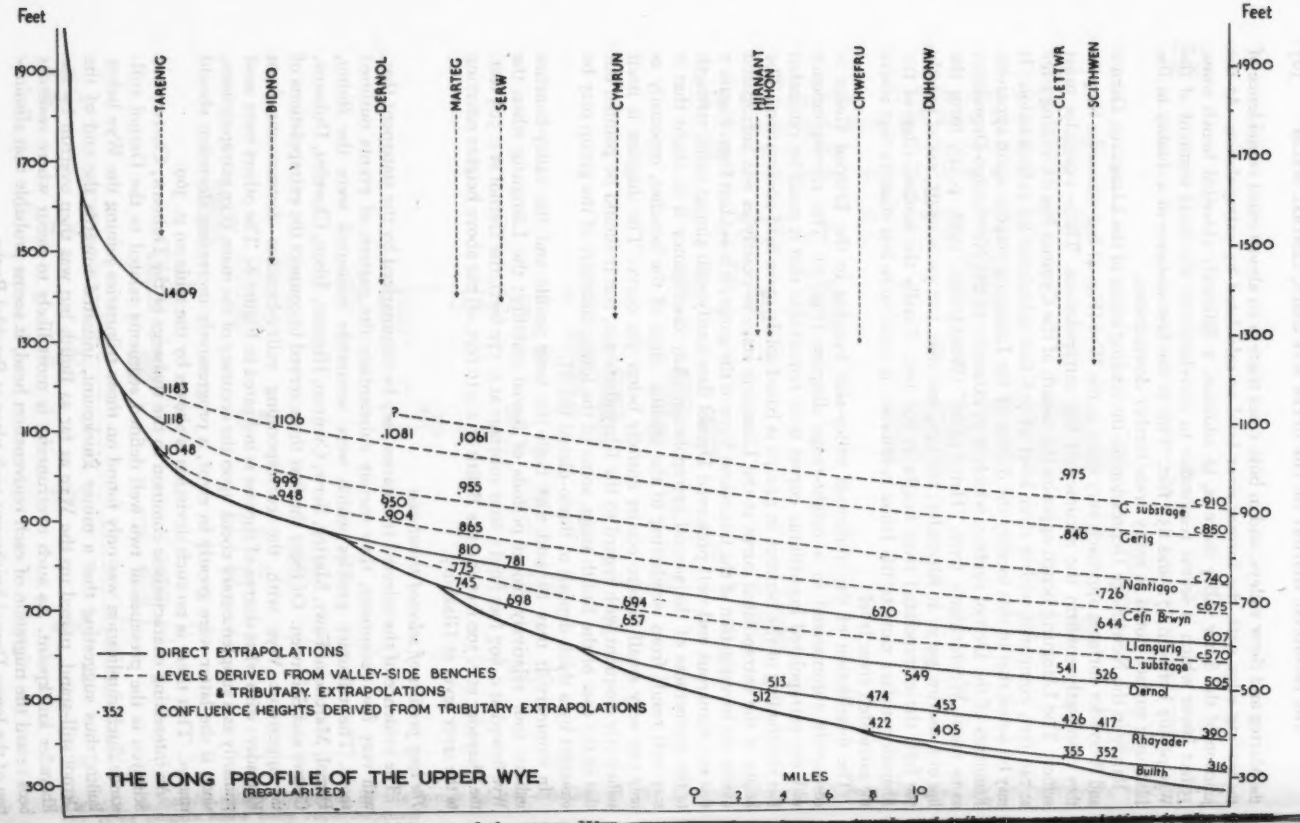
In summary it may be said that both the long profile and the valley-benches indicate four relatively recent periods of fluvial stability; the Llangurig when the Wye flowed at *c.* 607 feet (and a later substage at *c.* 570 feet), the Dernol at *c.* 505 feet, the Rhayader at *c.* 390 feet and the Builth at *c.* 316 feet, all the above heights referring to the river level at Glasbury.

The long profiles of selected tributaries

The evidence of the selected tributaries may be summarized by the statement that, with very few exceptions, they merely substantiate the pattern of events outlined above. The tributary profiles which were accurately measured were the Bidno, Dernol, Marcheini Fawr, Marteg, Serw, Cymrun, Hirnant, Ithon, Chwefru, Duhonw, Clettwr and Scithwen. Of these the first three served to connect the extrapolations of the uppermost Wye with the corresponding valley-benches downstream from Rhayader: with what degree of success is indicated in Figure 8. The others were used primarily as a supplementary check upon the accuracy of the main Wye extrapolations, since, if the latter were greatly in error, a progressively increasing deviation should emerge. That there is no such deviation is shown by the table on p. 369.

An interesting characteristic common to the thalwegs of the Duhonw, Clettwr and Scithwen is the presence of two well defined segments related to the Dernol still-stand. Such duplication was only found on those tributaries joining the Wye below Builth, thus suggesting that a minor knickpoint, initiated towards the end of the Dernol still-stand, passed up the Wye as far as Builth but was then overrun by the Rhayader knickpoint. As such overrunning is most likely to occur where resistant beds retard the migration of each rejuvenation head, it seems probable that elimination of the lower Dernol knickpoint took place at Penddol Rocks.

Fig. 7. A height-range diagram of the lower valley-benches in the Erwood Gorge. Curves obtained by extrapolating segments of the Wye profile have been superimposed


Feet
Feet
1900
1700
1500
1300
1100
900
700
500
300
TARENIG
BIDNO
DERNOL
MARTEG
SERW
CYMRUN
HIRNANT
ITHON
CHWEFRU
DUHONW
CLETTWR
SCITHWEN
1409
1183
1118
1048
1106
999
948
1081
950
904
1061
955
865
810
775
745
781
698
694
657
670
549
513
512
474
453
422
405
426
417
355
352
975
846
726
644
541
526
C. substage
Cerig
Nantiago
Cefn Brwyn
Llangurig
L. substage
Dernol
Rhayader
Builth
c910
c850
c740
c675
607
c570
505
390
316
DIRECT EXTRAPOLATIONS
LEVELS DERIVED FROM VALLEY-SIDE BENCHES & TRIBUTARY EXTRAPOLATIONS
·352 CONFLUENCE HEIGHTS DERIVED FROM TRIBUTARY EXTRAPOLATIONS
THE LONG PROFILE OF THE UPPER WYE
(REGULARIZED)
MILES
0 2 4 6 8 10

Name of tributary	*Relationship (in feet) of confluence levels calculated from the tributary profiles to those calculated from the Wye profile*			
	Llangurig Stage	*Dernol Stage*	*Rhayader Stage*	*Builth Stage*
Marteg	+6	+4	—	—
Serw	−1	−0	—	—
Cymrun	—	+7	—	—
Hirnant	—	—	−1	—
Ithon	—	—	0	—
Chwefru	—	—	0	+4
Duhonw	—	−10	−10	+7
Clettwr	—	+5	−4	−4
Scithwen	+13	−2	−2	+4

Tentative correlation and conclusions

It is natural to seek, wherever possible, correlation of the upper Wye stages with those recognized by Miller on the lower Wye. The writer is fully aware of the dangers of long distance extrapolation, but the results of extending the curves fitted to the upper Wye profile as far as the present coast certainly provide interesting comparison (and striking similarities) with those obtained elsewhere in Great Britain.

Name of Stage	*Height at Glasbury*	*Height at coast*
	feet	*feet*
Llangurig	607	406
Dernol	505	325
Rhayader	390	176
Builth	316	85

From a study of the confluence heights Miller derived by extrapolating the Wye tributaries in the Forest of Dean it may be tentatively suggested that the Llangurig and Rhayader stages are the equivalents of the Forest of Dean and Liveoaks stages respectively (Miller, 1935). The Dernol and Builth stages detected only on the upper Wye correspond closely to former stable sea levels widely recognized throughout the British Isles. There remain, however, the pre-Llangurig stages and on the correlation of these little can be said. The Rhudd stage may well be the equivalent of Miller's 900–1000-foot summit level surface in the Forest of Dean; the considerable length of this still-stand in comparison with its successors would accord with Miller's thesis that the meanders of the lower Wye were initiated at this time. On the other hand there is considerable doubt about the course followed by the Wye at this high level. The Gwy stage may also be the homologue of the widely recognized 1250-foot planation round the coasts of Great Britain (*e.g.* Sawicki, 1912, and Macar, 1936). But of the Gerig, Nantiago and Cefn Brwyn stages it can only be stated that their heights at Glasbury are *c.* 850, 740 and 675 feet; in our present state of knowledge the corresponding sea levels cannot be accurately assessed.

Finally the writer wishes to acknowledge the great help and encouragement given him by Professor S. W. Wooldridge, Professor P. R. Crowe and Dr. E. H. Brown. He is also indebted to Miss T. Bungard who has kindly redrawn Figures 2, 3, 5 and 7.

REFERENCES

Balchin, W. G. V. (1952). "The Erosion Surfaces of Exmoor and Adjacent Areas," *Geogr. J.* 118, p. 453.

Brown, E. H. (1952). "The River Ystwyth, Cardiganshire: a geomorphological analysis," *Proc. Geol. Ass., Lond.* 63, p. 244.

Dwerryhouse, A. R., and A. A. Miller (1927). "The glaciation of Radnorshire and parts of the adjoining counties," *Rep. Brit. Ass.* (Leeds), p. 328.

Dwerryhouse, A. R., and A. A. Miller (1930). "The glaciation of Clun Forest, Radnor Forest, and some adjoining districts," *Quart. J. geol. Soc., Lond.* **86**, p. 96.

Earp, J. R. (1928). "The higher Silurian rocks of the Kerry district, Montgomeryshire," *Quart. J. geol. Soc., Lond.* **94**, p. 125.

George, T. N. (1942). "The development of the Towy and upper Usk drainage pattern," *Quart. J. geol. Soc., Lond.* **98**, p. 89.

Green, J. F. N., and others (1934). "The River Mole: its physiography and superficial deposits," *Proc. Geol. Ass.* **45**, p. 35.

Hollingworth, S. E. (1938). "The recognition and correlation of high-level erosion surfaces in Britain: a statistical study," *Quart. J. geol. Soc., Lond.* **94**, p. 55.

Howard, F. T. (1904). 'Origin of physical features in South Wales, with notes on glacial action in Brecknockshire and adjoining districts.' Cardiff.

Johnson, D. (1938). "Stream profiles as evidence of eustatic changes of sea level," *Journ. of Geomorph.*, **1**, p. 178.

Jones, O. T. (1912). "The geological structure of Central Wales and adjoining regions," *Quart. J. geol. Soc., Lond.* **68**, p. 328.

Jones, O. T. (1947). "The geology of the Silurian rocks west and south of the Carneddau Range, Radnorshire," *Quart. J. geol. Soc., Lond.* **103**, p. 1.

Jones, O. T. (1951). "The drainage systems of Wales and the adjacent regions," *Quart. J. geol. Soc., Lond.* **107**, p. 201.

Jones, O. T., and W. J. Pugh (1948). "The form and distribution of dolerite masses in the Builth-Llandrindod inlier," *Quart. J. geol. Soc., Lond.* **104**, p. 71.

Lake, P. (1934–35). "The rivers of Wales and their connection with the Thames," *Sci. Progr. Twent. Cent.* (1934–35), **29**, p. 25.

Macar, P. (1936). "Quelques remarques sur la géomorphologie des Cornouailles et du sud du Devonshire," *Ann. Soc. Geol. Belge.* **60**, p. 152.

Miller, A. A. (1935). "The entrenched meanders of the Herefordshire Wye," *Geogr. J.* **85**, p. 160.

Miller, A. A. (1939). "Attainable standards of accuracy in the determination of pre-glacial sea levels by physiographic methods," *Journ. of Geomorph.* **2**, p. 95.

Rice, R. J. (1957). "The drainage pattern and upland surfaces of South Central Wales," *Scot. geogr. Mag.* **73**.

Roberts, R. O. (1929). "The geology of the district around Abbey Cwmhir (Radnorshire)," *Quart. J. geol. Soc., Lond.* **85**, p. 651.

Sawicki, L. (1912). "Die Einebnungsflächen in Wales und Devon," *C.R. Soc. Sci. Varsovie*, **5**, p. 123.

Straw, S. H. (1937). "The higher Ludlovian rocks of the Builth district," *Quart. J. geol. Soc., Lond.* **93**, p. 406.

Wooldridge, S. W. (1928). "The 200-foot platform in the London Basin," *Proc. Geol. Ass.* **39**, p. 1.

A CLASSIFICATION OF SERVICE CENTRES IN ENGLAND AND WALES

IAN CARRUTHERS

THIS PAPER IS concerned with the study of the relationships between "town" and "countryside" in England and Wales and in particular with those places on which these relationships centre. Such places are referred to here as "service centres" because they act as the centres where shopping, entertainment, cultural, professional and similar services are sought by people from the surrounding areas. The centres extend over a complete range, varying in status from places of a very limited local significance to those whose influence is regional and, in the case of London, national. The less important a centre the greater its dependence upon other more important service centres. Ranged each according to status the centres could be made to form an almost continuous list but it is more convenient to think of them as being organized into the ranks or successive orders of a hierarchy or gradation, though the divisions proposed may not always be clear cut or well defined.

This concept has already been introduced by several geographers [1] but mention may be most usefully made here of the five orders suggested by F. H. W. Green; examples of places in the various orders are: *first order*—London; *second order*—Bristol, Newcastle; *third order*—Chelmsford, Taunton, Worcester, York; *fourth order*—Bridgwater, Ely, Ripon; *fifth order*—Local village centre. Such a classification or hierarchy of centres based on an analysis of public road passenger transport is set out in the present paper for England and Wales: all the places discussed are considered to be at least *fourth order* centres.

Lack of definition between constituent orders or ranks is of course a feature of many hierarchies and there may be very little to differentiate the least able members of one rank from the best of that beneath it. To carry the analogy further it may be noted that promotion and demotion are features characteristic of many hierarchies, and towns may be gaining or losing importance as centres. The overall number and/or relative numerical strength of the various orders may change with changing circumstances so that, as in so many geographical studies, an appreciation must be made in time as well as in space.

It is important at the outset to stress that in general a centre included in one of the higher orders also carries out, usually for a less extensive area, functions of a type more characteristically associated with centres of a lower order, in a way comparable to that in which an officer of a higher rank may, in respect of part of his command, discharge duties fulfilled elsewhere by officers of a lower rank. Thus all the places in the postulated hierarchy have *fourth order* functions, far fewer *third order* functions, and fewer still *second order* functions, while London alone is of the *first order*. As the present classification is based on town-country relationships interest is focused primarily on towns and other settlements as local, district or regional centres, and only secondarily and indirectly on the actual services which they have to offer. A comparison is attempted towards the end of this paper with a classification actually based on the equipment of towns—the "urban hierarchy" of A. E. Smailes.[2]

In the Explanatory Text accompanying the map "Local Accessibility," published

[1] For instance, R. E. Dickinson, A. E. Smailes, F. H. W. Green, J. B. Fleming and H. Bracey in this country; Christaller and other writers in Germany; H. J. Keuning in the Netherlands and John Brush in the U.S.A.

[2] Smailes, A. E., "The Urban Hierarchy in England and Wales," *Geography*, 29 (1944), pp. 41–51.

as one of the national series of planning maps on a scale of about 10 miles to 1 inch, and in earlier published papers,[1] the analysis of public road transport has already been described as a means of defining the areas looking to certain places which act as service centres. But in examining the status of these places as such centres, the assumption is here made that a count of the amount and type of public road transport into any centre, reflecting physical accessibility and the existence of some sort of town-country association, will give a fair indication of status. This status is further elucidated by investigating the pattern of centres and the chain of relationships formed by the system of dependence of the less important on the more important centres—assuming that public road transport links between towns are an important expression of these relationships. Public road transport is investigated as one aspect of the overall problem and only later can some assessment of its value be made, in relation to other approaches.

As long ago as 1944, A. E. Smailes noted that ". . . an analysis of quantitative data relating to bus traffic . . . would have provided another invaluable measure of urban rank."[2] Bus traffic is especially useful as a means of giving some indication of the nodality of any centre. The bus operators have discovered "by a process of trial and error . . . where the majority of persons wished to make the majority of journeys."[3] All information used in the count was taken for the winter period, when conditions are not, for example, affected by the introduction of holiday services. The examination was generally made for Saturday, when the function of the places as centres for the surrounding countryside is most evident. In the case of small market towns allowance was made for services running on market day for which no complementary Saturday service existed. All normal stage carriage services were taken into account, except that purely local "town" or suburban services operating entirely within the built-up area of any town were ignored. Of the express services, those running very infrequently to coastal resorts from distant parts of the country were considered irrelevant; express coach services to London were investigated separately. Apart from these two general exceptions other coach or express services were included. All special services, such as those to schools and factories, were left out. The timetables used were for the winter period 1947–8 so that conditions here referred to in the present tense actually refer to that particular winter. It is unfortunate that the material is somewhat dated, but the same information has already been used to define certain hinterland boundaries[4] and the pattern of services was certainly then almost fully developed, although it is inevitable that some changes have since taken place.

In applying the data the limitations of the process are rather obvious. The seating capacity is unknown, as is the number of passengers, while the actual number of bus journeys made may be varied by the introduction of relief services. Then there are other ways of travelling; by rail, for instance, by private car or by bicycle, the last-named being of considerable importance in certain parts of the country such as East Anglia. Two sets of information were collected for each centre: first, the total number of bus journeys made into or through the town, and second, the number of journeys into or through the town which serve no centre larger than the town itself. For practical purposes "larger" was taken to mean larger in terms of population and while this was not entirely satisfactory, at least all the places under consideration have some claim to be centres. The information mapped can be interpreted with the population factor in mind.

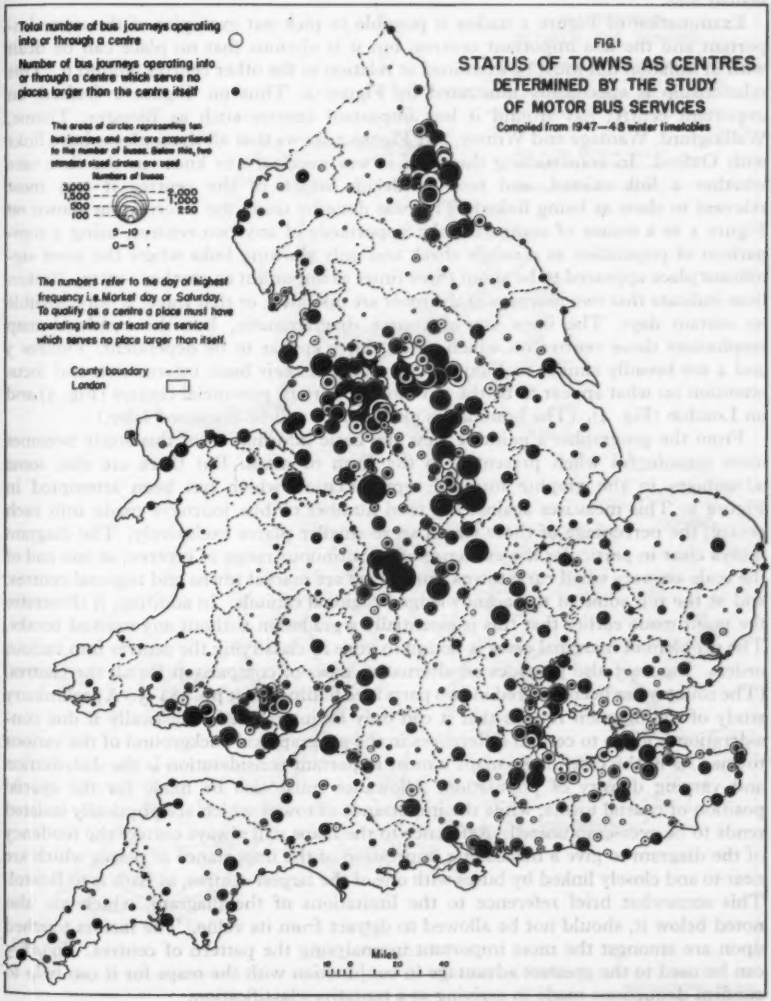
[1] Green, F. H. W., "Urban Hinterlands in England and Wales: an analysis of bus services," *Geogr. J.* **116** (1950), pp. 64–88.

[2] Smailes, A. E., *op. cit.*, foot of p. 49.

[3] Green, F. H. W., *op. cit.*, p. 65.

[4] "Local accessibility, the hinterlands of towns and other centres as determined by an analysis of bus services," one of the national series of planning maps on a scale of approximately 10 miles to 1 inch.

It has already been explained elsewhere[1] that, to qualify as a centre, a place had to have operating into it at least one bus service on which bus journeys were made which served no place larger than the town itself. Such services are here termed "qualifying" services. Thus the second set of figures taken as they stand or expressed as a percentage of the total, can be taken to indicate the degree to which any place qualifies


Total number of bus journeys operating into or through a centre
Number of bus journeys operating into or through a centre which serve no places larger than the centre itself
The areas of circles representing ten bus journeys and over are proportional to the number of buses. Below this, two standard sized circles are used
Numbers of buses
3,000
1,500
500
100
5,000
1,000
250
5—10
0—5
The numbers refer to the day of highest frequency i.e. Market day or Saturday. To qualify as a centre a place must have operating into it at least one service which serves no place larger than itself.
County boundary
London
FIG.1
STATUS OF TOWNS AS CENTRES DETERMINED BY THE STUDY OF MOTOR BUS SERVICES
Compiled from 1947—48 winter timetables
Miles
0
20
40

CROWN COPYRIGHT RESERVED

as a centre. The extraction of this data enabled Figure 1 to be constructed to illustrate the nodality of all the centres, and as a basic step towards arriving at a classification. The complete symbol represents the total amount of traffic, the inner part represents that serving smaller places exclusively. Much can be inferred both from

[1] Explanatory Text No. 6, "Local Accessibility," Director-General O.S. 1955, p. 4.

a consideration of the size of the symbols, and of the relative proportions of their two parts. By far the most important factor to be borne in mind in examining the map is the distribution of population, which contrasts the more rural with the more heavily urbanized parts of the country. Symbols for places on the coast reflect the restricted area within a given radius of a town, compared with inland towns of similar size.

Examination of Figure 1 makes it possible to pick out examples of the more important and the less important centres, but it is obvious that no place can be dealt with in isolation but must be examined in relation to the other centres around it. This relationship is specifically illustrated by Figure 2. Thus on Figure 1 Oxford, an important centre, has around it less important centres such as Bicester, Thame, Wallingford, Wantage and Witney, but Figure 2 shows that all these places have links with Oxford. In constructing this map it was necessary to know in the first case whether a link existed, and next to decide which of the centres it was most relevant to show as being linked. This was done by using the information shown on Figure 1 as a means of comparing the importance of any two centres, using a comparison of population as a rough check and only showing links where the most significant place appeared to be about three times as important as another centre. Broken lines indicate that two journeys at the most are operated, or that travel is only possible on certain days. The lines are of course diagrammatic, but the resultant map emphasizes those centres on which other places appear to be dependent. Figures 3 and 4 are broadly similar to Figure 2 in respect of their basic information and focus attention on what appear to be the ten most important provincial centres (Fig. 3) and on London (Fig. 4). (The boundaries on Figure 3 will be discussed later.)

From the geographer's point of view the basic information of this study becomes most meaningful when presented in the form of maps. But there are also some advantages in the graphic form of representation which has been attempted in Figure 5. This measures against the total number of bus journeys made into each centre, the percentage of these which serve smaller places exclusively. The diagram makes clear in particular the existence of a continuous range of centres; at one end of the scale are very small rural towns, further up are market towns and regional centres, and at the top some of the acknowledged regional capitals. In addition, it illustrates the point made earlier that this is essentially a gradation without any marked breaks. The problem of marginal cases is bound to arise in classifying the centres into various orders. Figure 5 also provides an alternative basis of comparison for all the centres. (The country has been covered in two parts: see folding sheet pp. 384–5.) A preliminary study of the diagram reveals that it can only be interpreted realistically if due consideration is given to certain differences in the geographical background of the various towns. As in the case of the maps a most important consideration is the distribution and varying density of population. Allowance must also be made for the special position of coastal towns, while the importance of towns which are physically isolated tends to be over-emphasized. Reference to the maps will always correct the tendency of the diagram to give a misleading impression of the importance of places which are near to and closely linked by buses with one of the largest centres, as Bath is to Bristol. This somewhat brief reference to the limitations of the diagram, which are also noted below it, should not be allowed to detract from its value. The factors touched upon are amongst the most important in analysing the pattern of centres. Figure 5 can be used to the greatest advantage in conjunction with the maps for it can help to confirm deductions made in arriving at a tentative classification.

Classification of centres.—The *first order* is represented solely by London. Even to someone unfamiliar with the geography of England and Wales a comparison of Figures 3 and 4 would provide almost sufficient evidence for arriving at the conclusion that London has no rival as the only *first order* centre in the country. London's importance, even at *second order* level, is illustrated by the extent of its hinterland at the expense of other *second order* centres.

To represent the *second order*, centres of the greatest regional importance were selected in the first instance by reference to Figure 2. Birmingham, Bristol, Cardiff, Leeds, Manchester, Newcastle and Nottingham were listed. Their inclusion was confirmed by examination of Figure 1 which showed that each was the most important

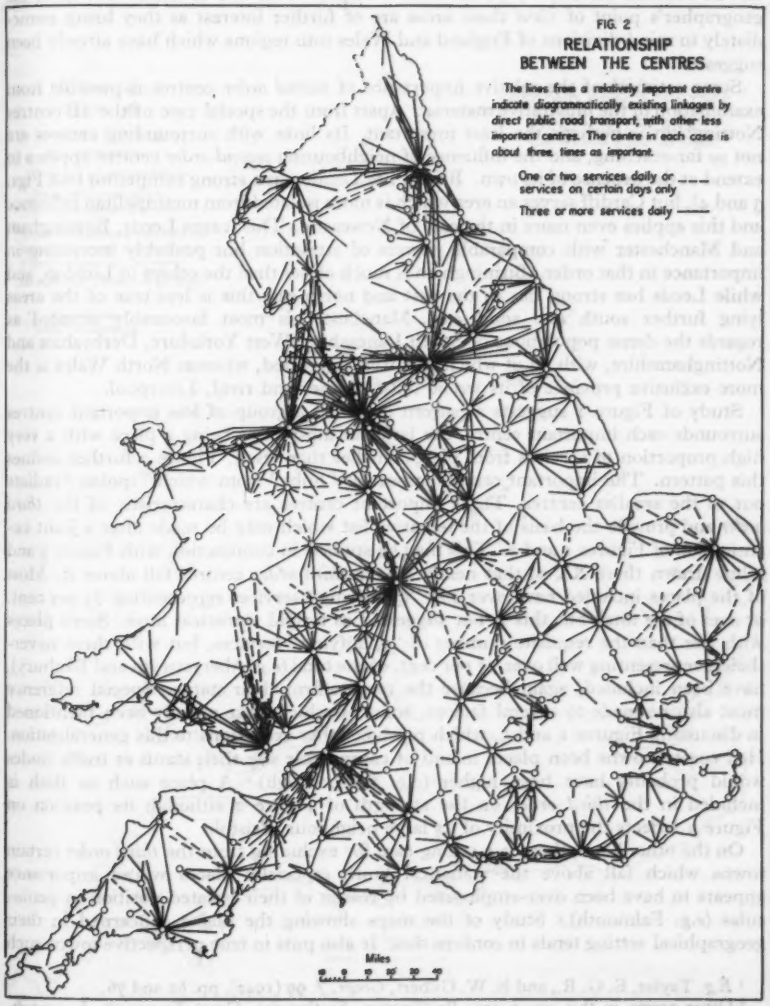


FIG. 2
RELATIONSHIP BETWEEN THE CENTRES
The lines from a relatively important centre indicate diagrammatically existing linkages by direct public road transport, with other less important centres. The centre in each case is about three times as important.
One or two services daily or ---- services on certain days only
Three or more services daily ——
Miles
0 5 10 15 20 25
CROWN COPYRIGHT RESERVED

centre in its own particular part of the country, a conclusion further established by examination of Figure 5. These were called 2A centres. Liverpool, Norwich and Plymouth are also outstanding: Liverpool is seen to bear a special relationship to Manchester, while Norwich and Plymouth are the most important centres in comparatively isolated parts of the country. These three were included in the 2B sub-order. Figure 3 has already been briefly mentioned: it indicates the existence of

direct public road transport services to *second order* centres. An attempt has been made to indicate on the map which areas are most accessible from each *second order* centre. The delimitation of these areas serves to confirm further the choice of centres in this category. As a generalization, it may be asserted that all parts of the country can be reached directly by public road transport from one of them. But from the geographer's point of view these areas are of further interest as they bring immediately to mind divisions of England and Wales into regions which have already been suggested.[1]

Some estimate of the relative importance of *second order* centres is possible from examination of the illustrative material. Apart from the special case of the 2B centres Nottingham is perhaps the least important. Its links with surrounding centres are not so far-reaching, and the influence of neighbouring *second order* centres appears to extend at the expense of its own. Bristol has London as a strong competitor (see Figs. 3 and 4), but Cardiff serves an area which is more isolated from metropolitan influence and this applies even more in the case of Newcastle. This leaves Leeds, Birmingham and Manchester with comparable powers of attraction but probably increasing in importance in that order. Birmingham is much closer than the others to London, and while Leeds has strong ties to the east and north-east this is less true of the areas lying further south and south-east. Manchester is most favourably situated as regards the dense populations of South Lancashire, West Yorkshire, Derbyshire and Nottinghamshire, with all of which it is well connected, whereas North Wales is the more exclusive province of its *second order* partner and rival, Liverpool.

Study of Figure 1 suggests a pattern in which a group of less important centres surrounds each important centre, the latter in most cases being a place with a very high proportion of services from places smaller than itself. Figure 2 further defines this pattern. The important centres appear as "hubs" from which "spokes" radiate out to the smaller centres. These important centres are characteristic of the *third order* and provide the basis of the tentative list which may be made after a joint examination of Figures 1 and 2. This may be studied in conjunction with Figure 5 and a line drawn there XX so that nearly all the *third order* centres fall above it. Most of the places included have over 175 "qualifying" services representing 75 per cent. or over of the total, but this is not suggested as a rigid statistical limit. Some places with less than the requisite number of "qualifying" services, but with these nevertheless representing well over 75 per cent. of the total (*e.g.* Aberystwyth and Banbury), have been included, again because the maps affirm their status. Special reference must also be made to several factors, some of which have already been mentioned in discussing Figures 1 and 5, which produce other exceptions to this generalization. Had coastal towns been places inland of comparable size their status as traffic nodes would probably have been higher (*e.g.* Scarborough).[2] A place such as Bath is included in the *third order* on the strength of Figure 2 although its position on Figure 5 reflects the proximity of its large neighbour, Bristol.[3]

On the other hand, there is a strong case for excluding from the *third order* certain towns which fall above the statistical limit, especially places whose importance appears to have been over-emphasized by reason of their isolated position in peninsulas (*e.g.* Falmouth).[4] Study of the maps showing the places concerned in their geographical setting tends to confirm this. It also puts in true perspective towns such

[1] *E.g.* Taylor, E. G. R., and E. W. Gilbert, *Geogr. J.* 99 (1942), pp. 62 and 76.

[2] Other towns in this group are: Bridlington, Eastbourne, Great Yarmouth, Lowestoft, Southport, Weston-super-mare and Whitehaven.

[3] Other places to which this applies are: Aylesbury, Canterbury, Carmarthen, Cheltenham, Chichester, Darlington, Dorchester, Durham, Harrogate, Hartlepool, Keighley, Kidderminster, Maidstone, Merthyr Tydfil, Rugby, Southport, Warrington, Warwick, Watford, Wigan, Winchester and Worcester.

[4] Other towns in this group are: Pembroke, Penzance, Redruth, St. Austell and Sheerness (Isle of Sheppey).

as Basingstoke, Blyth, Dartford, Ebbw Vale, Gravesend, High Wycombe and Stroud, which have not been included in the *third order*.

Reference to the 10-mile map "Local Accessibility" (*i.e. fourth order* hinterlands) shows the pre-eminence at the *fourth order* functional level of *third order* centres at

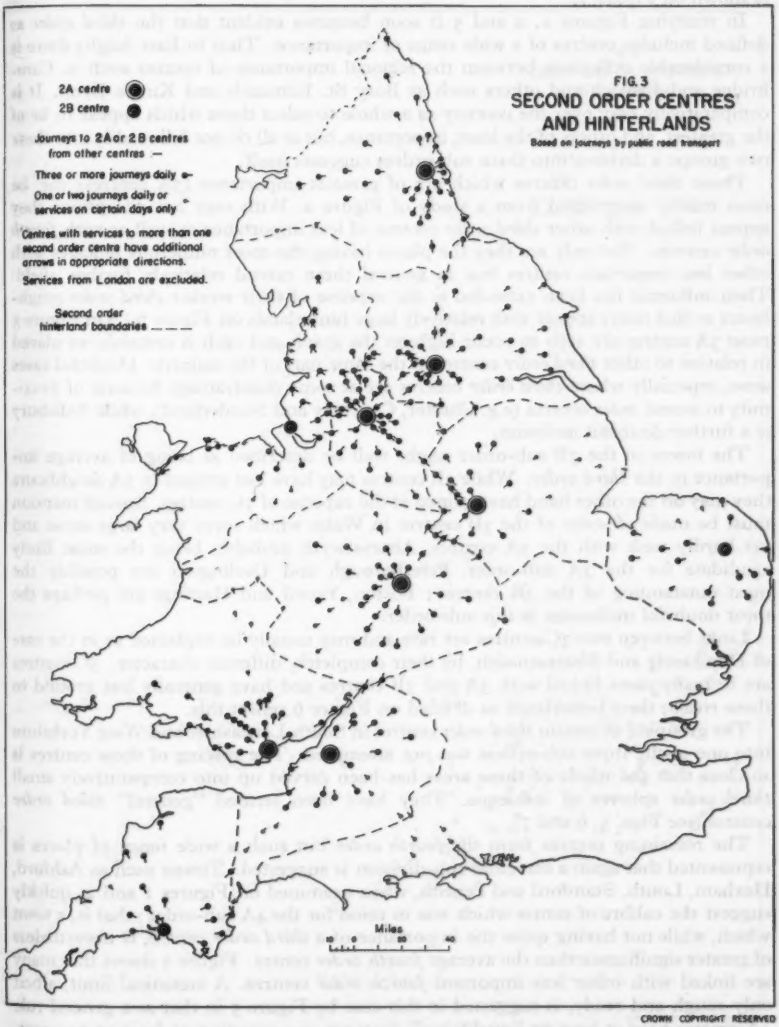

2A centre
2B centre
Journeys to 2A or 2B centres from other centres —
Three or more journeys daily
One or two journeys daily or services on certain days only
Centres with services to more than one second order centre have additional arrows in appropriate directions.
Services from London are excluded.
Second order hinterland boundaries
Miles
0
20
40

FIG. 3
SECOND ORDER CENTRES AND HINTERLANDS
Based on journeys by public road transport

CROWN COPYRIGHT RESERVED

the expense of weaker centres. The division between *third* and *fourth order* centres is fairly clear, but there is nevertheless a number of marginal cases. The inclusion of some coastal towns (*e.g.* Yarmouth and Southport) and some places (such as Rugby) near larger centres, is open to question. One might reaffirm here that such cases inevitably arise in setting out a classification. Figure 6 is an attempt to define the areas

most accessible to one *third order* centre rather than another—in other words, *third order* hinterlands. The method of drawing boundaries is the same as that described in the "Explanatory Text" to the 10-mile map "Local Accessibility" with reference to *fourth order* centres. The distribution of centres, including those of the *third order*, is shown on Figure 7.

In studying Figures 1, 2 and 5 it soon becomes evident that the *third order* as defined includes centres of a wide range of importance. Thus in East Anglia there is a considerable difference between the regional importance of centres such as Cambridge and Ipswich and others such as Bury St. Edmunds and King's Lynn. It is comparatively easy over the country as a whole to select those which appear to be of the greatest, and others of the least, importance, but as all do not fall readily into these two groups a division into three sub-orders suggests itself.

Those *third order* centres which are of greatest importance (3A centres) can be most readily ascertained from a study of Figure 2. With very few exceptions they appear linked with other *third order* centres of less importance as well as with *fourth order* centres. Not only are they the places having the most numerous linkages with other less important centres but in general these extend relatively further afield. Their influence has been extended at the expense of their weaker *third order* neighbours so that many appear with relatively large hinterlands on Figure 6.[1] On Figure 5 most 3A centres are seen to occur high on the graph and each is certainly so placed in relation to other *third order* centres in the same part of the country. Doubtful cases arise, especially where *third order* centres are at some disadvantage because of proximity to *second order* centres (*e.g.* Chester, Coventry and Sunderland), while Salisbury is a further doubtful inclusion.

The towns in the 3B sub-order might well be described as being of average importance in the *third order*. While 3B centres may have lost ground to 3A neighbours they may on the other hand have gained at the expense of 3C centres. Special mention must be made of some of the 3B centres in Wales which serve very large areas and yet hardly rank with the 3A centres, Aberystwyth probably being the most likely candidate for the 3A sub-order. Peterborough and Darlington are possibly the most outstanding of the 3B centres; Boston, Yeovil and Hastings are perhaps the most doubtful inclusions in this sub-order.

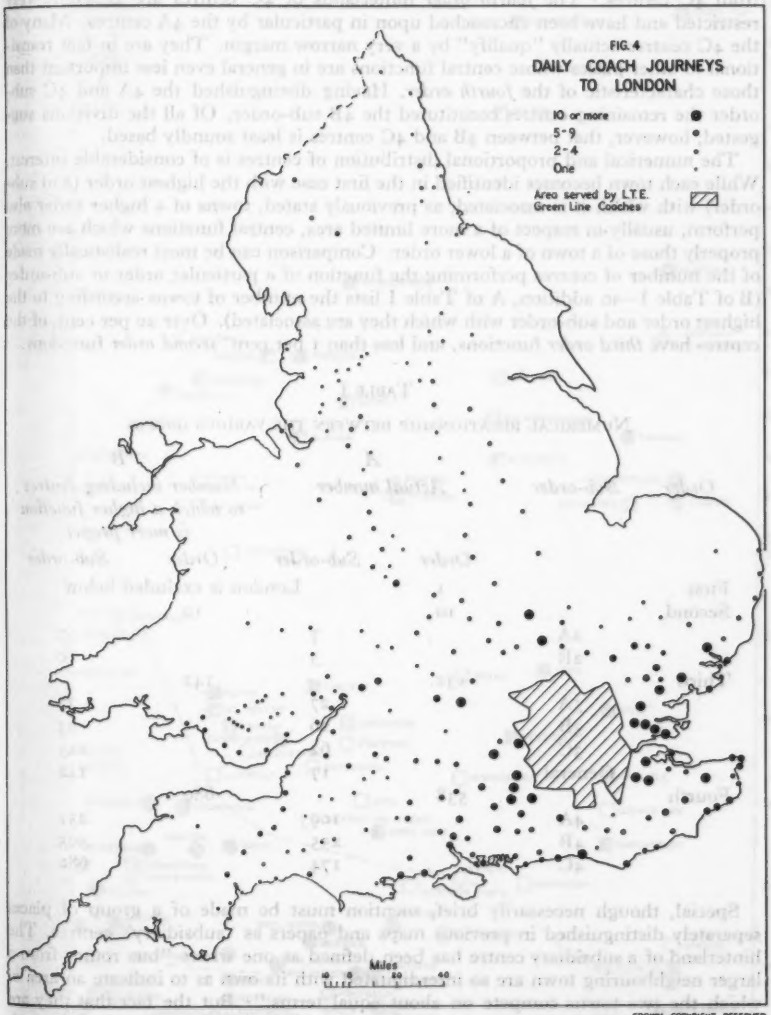
Links between two 3C centres are rare and may usually be explained as in the case of Dorchester and Bournemouth, by their completely different character. 3C centres are in many cases linked with 3A and 3B centres and have generally lost ground to these rivals; their hinterlands as defined on Figure 6 reflect this.

The grouping of certain *third order* centres in South Lancashire and West Yorkshire into one of the three sub-orders was not attempted. The spacing of these centres is so close that the whole of these areas has been carved up into comparatively small *third order* spheres of influence. They have been termed "general" *third order* centres (see Figs. 5, 6 and 7).

The remaining centres form the *fourth order* but such a wide range of places is represented that again a threefold sub-division is suggested. Towns such as Ashford, Hexham, Louth, Stamford and Penrith, when examined on Figures 1 and 2, quickly suggest the calibre of centre which was in mind for the 4A sub-order; that is, a town which, while not having quite the importance of a *third order* centre, is nevertheless of greater significance than the average *fourth order* centre. Figure 2 shows that many are linked with other less important *fourth order* centres. A statistical limit, albeit only rough and ready, is suggested in this case by Figure 5 in that as a general rule 4A centres have at least 75 "qualifying" journeys, representing at least 40 per cent. of the total. The line YY on Figure 5 is drawn so that practically all 4A centres fall above it. A few exceptions must be made in the case of some coast towns (*e.g.* Sidmouth, Skegness and Worthing) and others with a very high proportion of qualifying

[1] A map has been constructed showing hinterlands based on accessibility to 3A centres alone but does not appear here.

services such as Fakenham. The inclusion of Evesham, Ludlow, Melton and Ripon which fall slightly below this line was supported by Figure 2. Most of the places about which doubt arose are in densely populated areas and near large towns (Dudley, Morpeth, Pontefract, Pontypool and West Bromwich were considered 4A centres). It



is clear from an examination of the "Local Accessibility" map that 4A centres have gained at the expense of such of their neighbours as have only *fourth order* functions.

Somewhat less evidence was available to enable a division of the remaining centres into 4B and 4C sub-orders to be made because in this case Fig. 2 was of little or no assistance. A tentative list of the least important centres (*i.e.* 4C) was made with

reference to Figures 1 and 5 and eventually modified so as to include all centres with less than 15 "qualifying" services. In the vast majority of cases these represented less than 25 per cent. of the total number of bus journeys with very few cases indeed where the proportion rose above 30 per cent. The line ZZ on Figure 5 divides 4B from 4C centres.[1] The *fourth order* hinterlands of 4C centres are generally very restricted and have been encroached upon in particular by the 4A centres. Many of the 4C centres actually "qualify" by a very narrow margin. They are in fact transitional to other places whose central functions are in general even less important than those characteristic of the *fourth order*. Having distinguished the 4A and 4C sub-order the remaining centres constituted the 4B sub-order. Of all the divisions suggested, however, that between 4B and 4C centres is least soundly based.

The numerical and proportional distribution of centres is of considerable interest. While each town becomes identified in the first case with the highest order (and sub-order) with which it is associated, as previously stated, towns of a higher order also perform, usually in respect of a more limited area, central functions which are more properly those of a town of a lower order. Comparison can be most realistically made of the number of centres performing the function of a particular order or sub-order (B of Table I—in addition, A of Table I lists the number of towns according to the highest order and sub-order with which they are associated). Over 20 per cent. of the centres have *third order* functions, and less than 1 per cent. *second order* functions.

TABLE I

NUMERICAL RELATIONSHIP BETWEEN THE VARIOUS ORDERS

Order	*Sub-order*	*A* *Actual number*		*B* *Number including centres to which a higher function is more proper*	
		Order	*Sub-order*	*Order*	*Sub-order*
First		1	London is excluded below		
Second		10		10	
	2A		7		7
	2B		3		10
Third		132		142	
	3A		27		37
	3B		26		63
	3C		62		125
	General		17		142
Fourth		538		680	
	4A		109		251
	4B		255		505
	4C		174		680

Special, though necessarily brief, mention must be made of a group of places separately distinguished in previous maps and papers as "subsidiary" centres. The hinterland of a subsidiary centre has been defined as one where "bus routes from a larger neighbouring town are so interdigitated with its own as to indicate an area in which the two towns compete on about equal terms."[2] But the fact that they are subsidiary centres is not necessarily a reflection of their lack of importance, for each is only subsidiary to one particular centre, which may fall in almost any of the sub-orders of the classification. Not all subsidiary centres therefore fall in the lowest

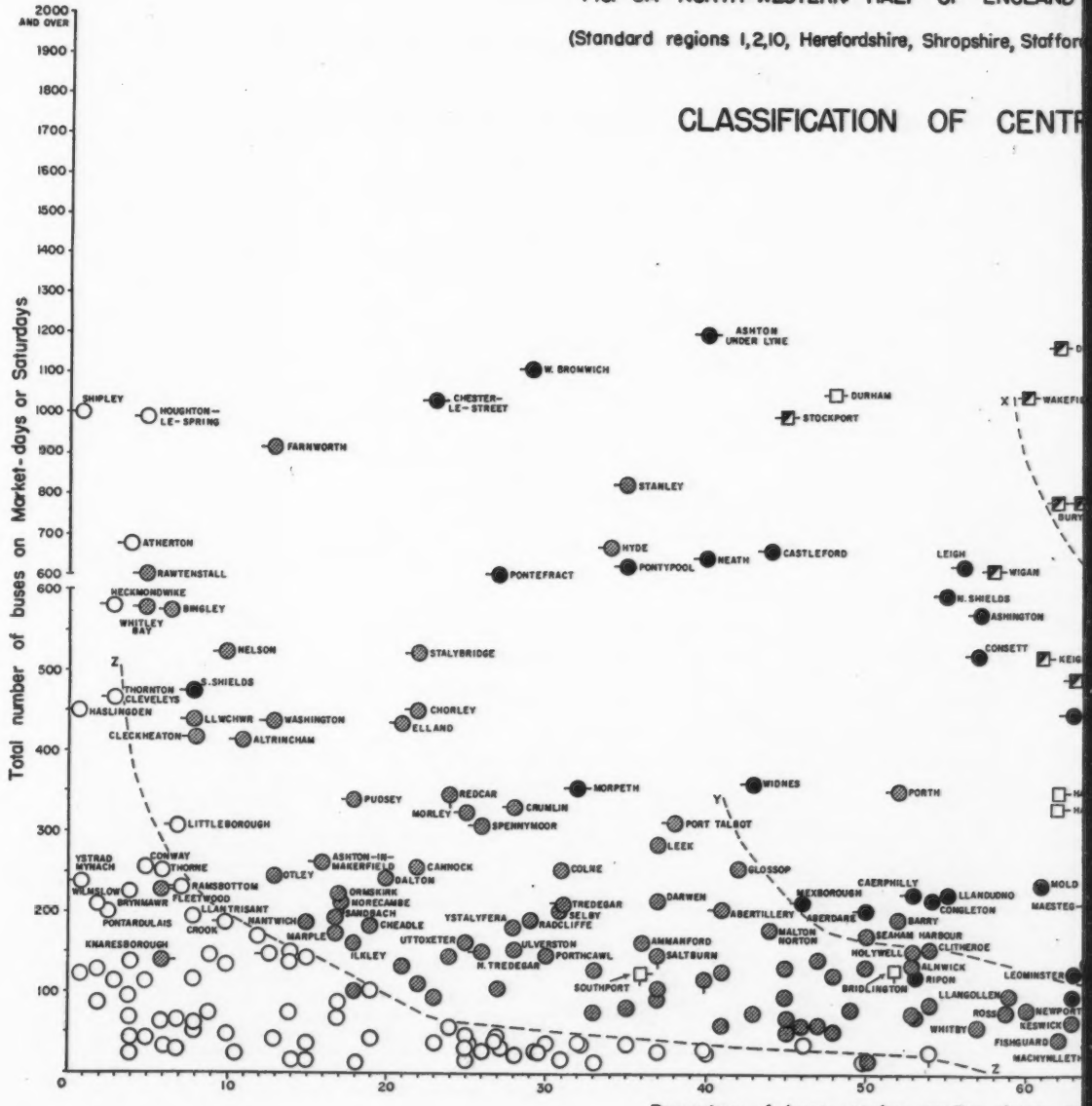
[1] Fleetwood, Knaresborough, Lewes and Sherborne, all close to large neighbours, are named exceptions.

[2] Green, F. H. W., *op. cit.*, p. 68.

FIG. 5A NORTH-WESTERN HALF OF ENGLAND

(Standard regions 1,2,10, Herefordshire, Shropshire, Staffor

CLASSIFICATION OF CENTR



LIMITATIONS OF THE GRAPH

Centres in areas where the density of population in the surrounding countryside is high

Important centres linked with neighbouring larger centres e.g. Keighley with Bradford

Coastal centres with restricted hinterlands

Centres which appear important because they are on islands or peninsulas

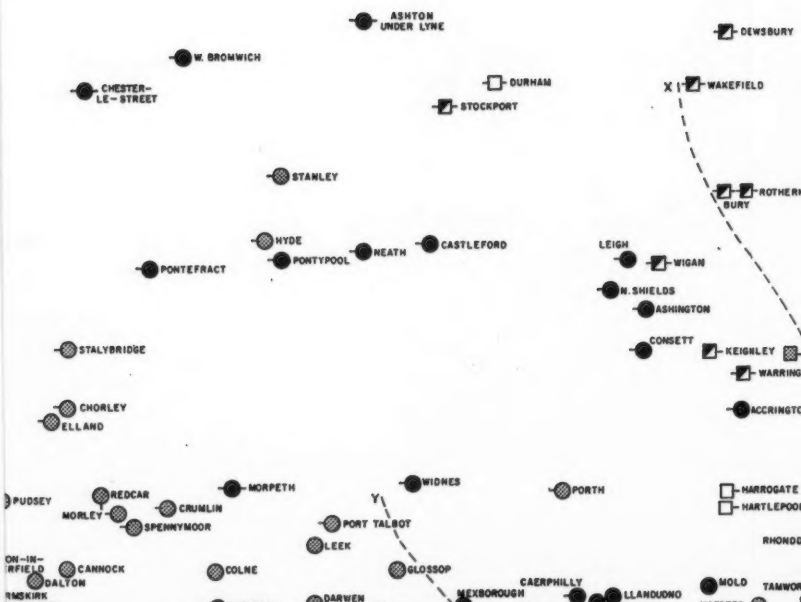
CLASSIFICATION OF CENTRES

Second Order	Third Order	Fourth Order
2A	3A	4A
2B	3B	4B
	3C	4C
	General	

FIG. 5A NORTH-WESTERN HALF OF ENGLAND AND

(Standard regions 1,2,10, Herefordshire, Shropshire, Staffordshire

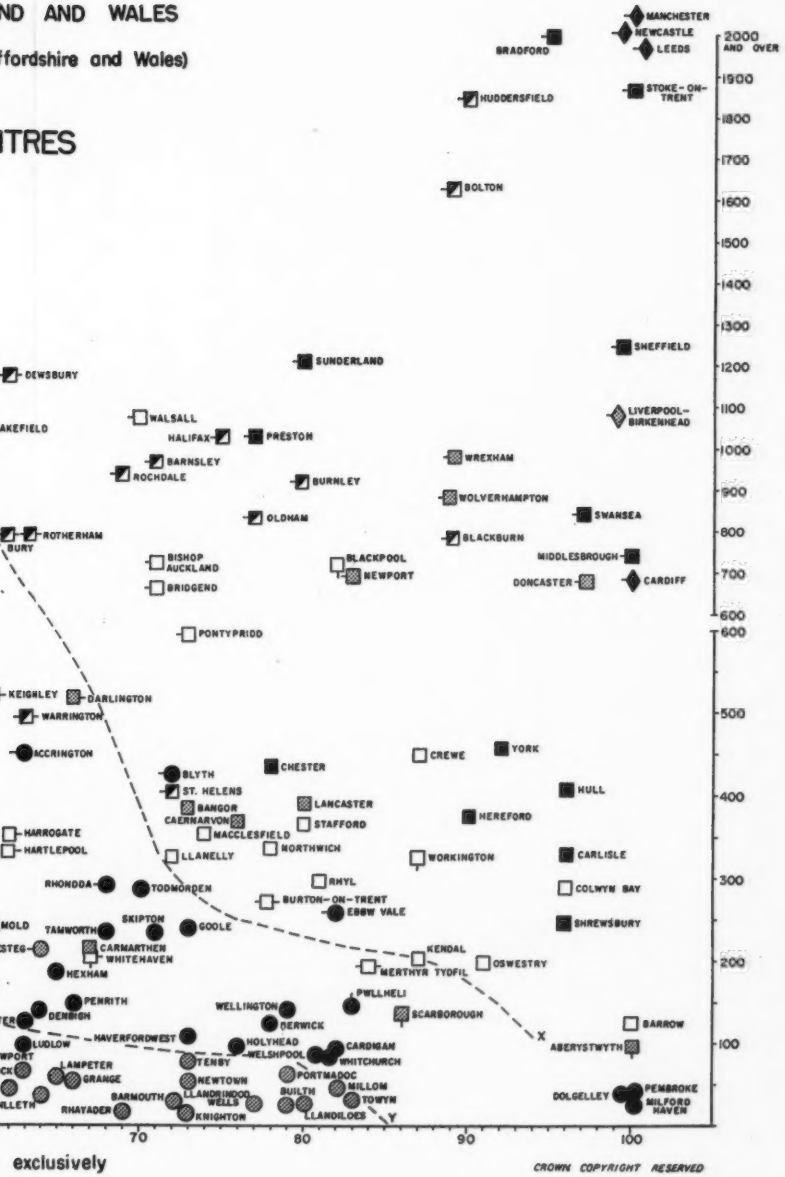
CLASSIFICATION OF CENTRES



ND AND WALES

ffordshire and Wales)

ITRES



exclusively

CROWN COPYRIGHT RESERVED

FIG. 5B SOUT

(Standard regi

CLA

LIMITATIONS OF THE GRAPH

Centres in areas where the density of population in the surrounding countryside is high

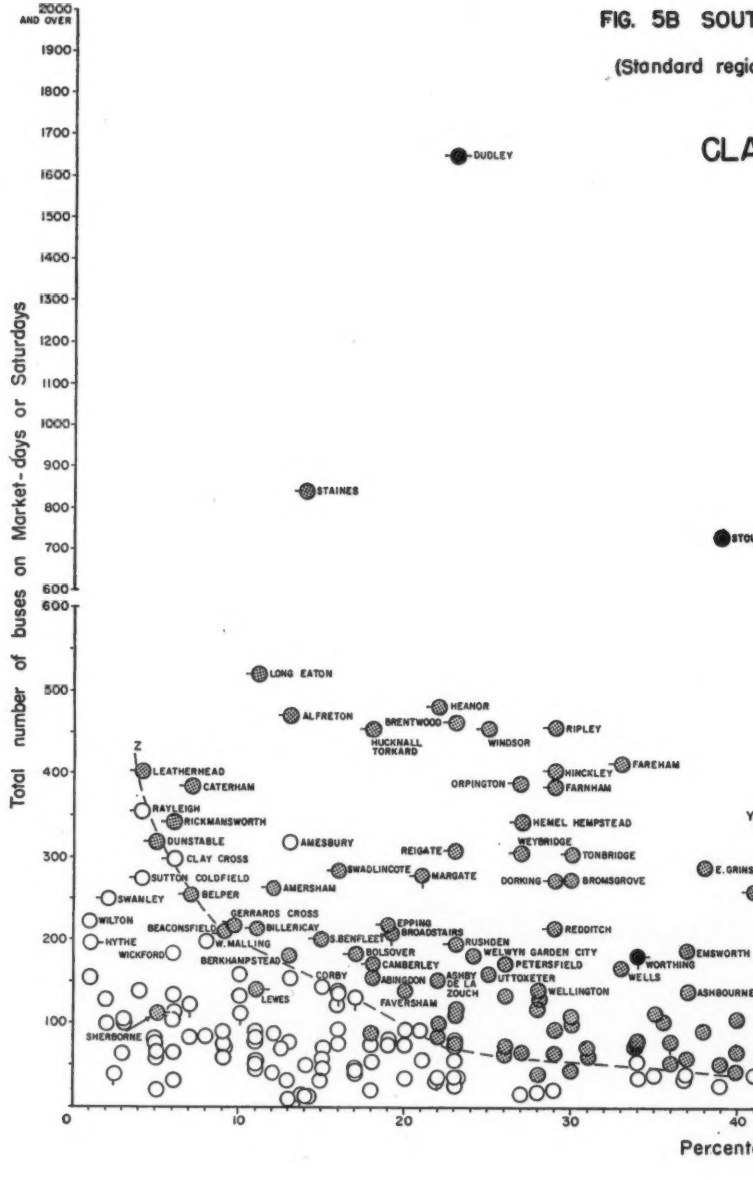
Important centres linked with neighbouring larger centres e.g. Bath with Bristol

Coastal centres with restricted hinterlands

Centres which appear important because they are on islands or peninsulas

CLASSIFICATION OF CENTRES

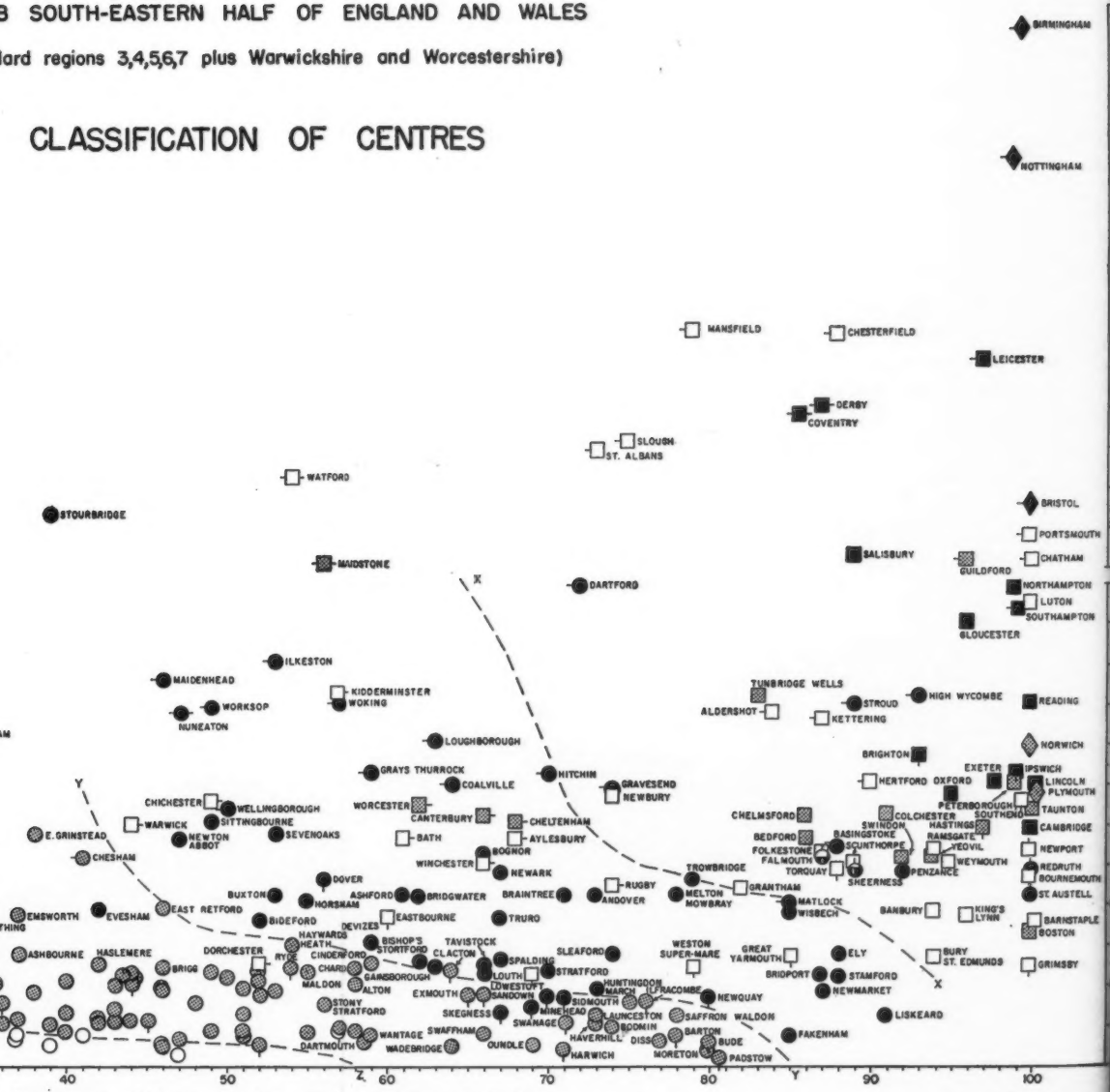
Second Order	Third Order	Fourth Order
2A	3A	4A
2B	3B	4B
	3C	4C



B SOUTH-EASTERN HALF OF ENGLAND AND WALES

lard regions 3,4,5,6,7 plus Warwickshire and Worcestershire)

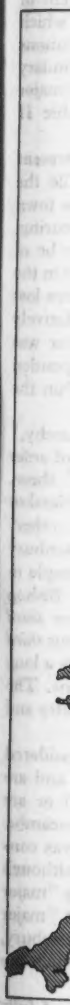
CLASSIFICATION OF CENTRES



Percentage of buses serving smaller places exclusively

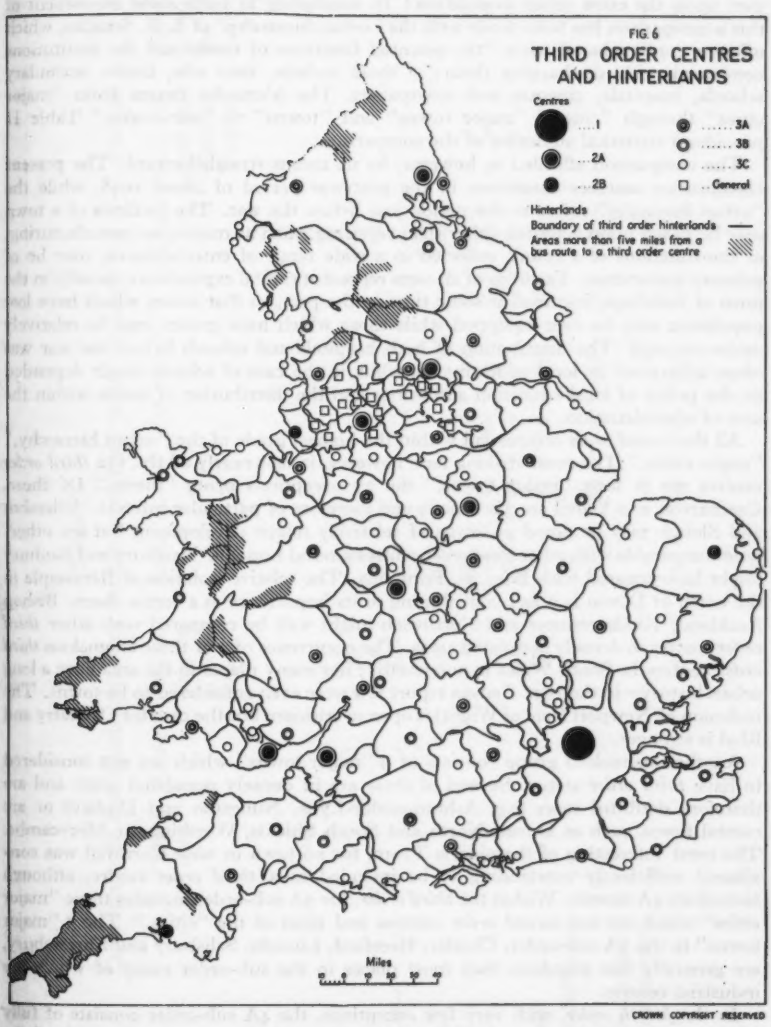
CROWN COPYRIGHT RESERVED

(*i.e.* 4
portan
are sul
lie in



the defi
densely
remainir
restricte
The f

(*i.e.* 4C) sub-order as might be thought at first; 31 are in fact of sufficient importance to be considered 4B centres. Of these only 5 lie in more rural areas and are subsidiary to centres which have *third* as well as *fourth order* functions. The rest lie in densely populated areas where interdigitation of routes is more complicated and



the definition of hinterlands so much more difficult. Even the ten 4C centres in densely populated areas might be considered marginal to the 4B sub-order. The remaining 40 subsidiary centres are small rural 4C centres, generally with very restricted hinterlands and dominated by the centres to which they are subsidiary.

The foregoing classification of centres depends entirely upon research into one

criterion, public road transport services, a means of investigation which, it is claimed, provides some measure of the importance of towns in their local relations. But to what extent does this reflect actual facilities and services available in the places concerned, which depend primarily on the population of the town itself and only in part upon the extra urban population? In attempting to form some assessment of this a comparison has been made with the "urban hierarchy" of A. E. Smailes, which offers a grading based upon "the essential functions of towns and the institutions concerned with discharging them;" [1] these include, *inter alia*, banks, secondary schools, hospitals, cinemas and newspapers. The hierarchy ranges from "major cities" through "cities," "major towns" and "towns" to "sub-towns." Table II provides a statistical summary of the comparison.

The comparison afforded is, however, by no means straightforward. The present classification assesses conditions in the post-war period of about 1948, while the "urban hierarchy" refers to the period just before the war. The facilities of a town may be based upon activities other than servicing, such as mining or manufacturing, or the functions of a resort, reflected in a wide range of entertainment, may be of primary importance. Facilities of all sorts represent capital expenditure, usually in the form of buildings, incurred at some time in the past, so that towns which have lost population may be over-equipped while those which have grown may be relatively under-serviced. The distribution of both hospitals and schools before the war was often influenced by local endowments, while in the case of schools much depended on the policy of local education authorities and the distribution of towns within the area of administration.

All the *second order* centres fall within the highest grade of the "urban hierarchy," "major cities." The most striking fact, however, is that nearly all the 132 *third order* centres are at least "major towns," the 17 exceptions being "towns." Of these, Caernarvon and Yeovil are 3B centres and therefore of particular interest. Aldershot and Slough may be noted as towns of relatively recent development but are otherwise comparable with other *third order* centres around London. Newbury and Banbury might be compared with Bury St. Edmunds. The relative isolation of Barnstaple in the north of Devon is a fact contributing to its importance as a centre there. Bishop Auckland, Kidderminster and Northwich might well be compared with other *third order* centres in densely populated areas. The occurrence of 4 of these anomalous *third order* centres in South Wales is noteworthy; not many places in the area have a long urban history—in the 1851 Census report few were even considered to be towns. The inclusion of Newport (Isle of Wight) is open to criticism but the case for Oswestry and Rhyl is stronger.

Another anomalous group consists of 9 "major towns" which are not considered to have *third order* status. Several of these are in densely populated areas and are therefore doubtful cases (*e.g.* Ashton-under-Lyne, Nuneaton and Dudley) or are coastal towns such as Dover, North and South Shields, Worthing, or Morecambe. The most interesting of the nine is Truro, for no town in west Cornwall was considered sufficiently outstanding to be included as a *third order* centre, although several are 4A centres. Within the *third order*, the 3A sub-order includes those "major cities" which are not *second order* centres and most of the "cities." The 5 "major towns" in the 3A sub-order, Chester, Hereford, Lincoln, Salisbury and Shrewsbury, are generally less populous than most places in the sub-order many of which are industrial centres.

In the *fourth order*, with very few exceptions, the 4A sub-order consists of fully fledged "towns." Nearly two-thirds of the 4B sub-order are also "towns" of the "urban hierarchy." The 24 "towns" in the 4C sub-order in many cases suffer from the proximity of larger and better equipped neighbours (*e.g.* Romsey near Southampton, Sutton Coldfield near Birmingham). Others lie in areas where several small towns are in competition (the north of East Suffolk) or lie on the coast. The greatest apparent divergence between the two classifications is in the case of "sub-towns"

[1] Smailes, A. E., *op. cit.*, p. 41.

TABLE II

COMPARISON OF THE CLASSIFICATION OF CENTRES WITH THE "URBAN HIERARCHY" OF A. E. SMAILES

	"Major cities"	*"Cities"*	*"Minor cities" or "major towns"*	*"Towns"*	*"Sub-towns"*				*Total*	*Places considered with others by Smailes*	*Places not included in the "urban hierarchy"*	*Total*
					X	*Y*	\	/				
2A	7								7			7
2B	3								3			3
2	10								10			10
3A	5	17	5						27			27
3B		1	23	2					26			26
3C		2	45	15					62			62
3 Gen.		1	16						17			17
3	5	21	89	17					132			132
4A			8	97	1		2	1	109			108
4B			1	159	13	9	37	9	228	3	24	255
4C				24	10	10	41	10	95	2	77	174
4			9	280	24	19	80	20	432	5	101	538
Total	15	21	98	297	24	19	80	20	574	5	101	680
Places not included as bus centres				32	23	5	47	10	117	—	—	117
Places considered jointly with other bus centres ..				9	1	3	4		17	—	—	17
Total	15	21	98	338	48	27	131	30	708	5	101	814

of which there are four groups. In discussing "sub-towns" as a whole it seems reasonable to assume that importance as bus traffic centres will reflect good shopping and entertainment facilities, rather than schools, hospitals and newspapers. Hence it is not surprising that over half the places considered as "sub-towns" rather than "towns" in the "urban hierarchy," because of inferior social facilities (shown by the symbols X and Y on Smailes' map), fall in the 4B sub-order. Many of those in the 4C sub-order lie close to larger centres of higher ranking which supply the social facilities but at the same time in other ways overshadow them as centres. On the other hand, it is common for social services to be duplicated in the case of relatively isolated towns. The group of "sub-towns" shown by the symbol / includes places having inferior shopping facilities but a considerable provision of social services. But while the shopping may be inferior when compared with larger places, the importance of such centres for the local population may be considerable (*e.g.* Chipping Norton, Kington and Towyn). The most numerous group of "sub-towns" shown by the symbol \ includes essentially "an intermediate type of settlement, indicative either of emergent townhood or lost status as towns." [1] The fact that some of these places may be emerging as towns is of particular interest and may explain why some are relatively important as bus centres. A much higher proportion, however, represent small places in areas where population is less dense. They are almost entirely "service" in character and there is no urban population associated with local industry which might support a wide range of services. At the same time, especially in isolated areas (*e.g.* Millom and Moreton-in-the-Marsh), they may be relatively important as bus centres.

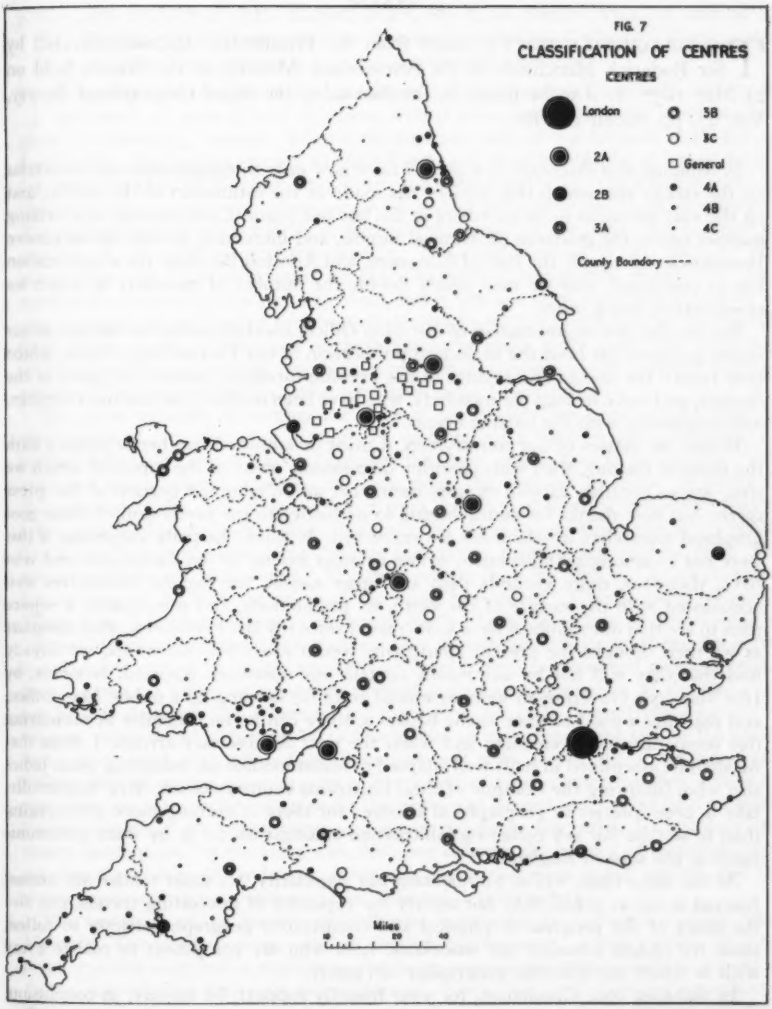
Of the 101 places which, although qualifying as bus centres, are not included in the "urban hierarchy," only 24 rank as high as the 4B sub-order. Of these several are to be found in areas of increasing population around London (*e.g.* Billericay, Epping and Rickmansworth), others lie in relatively isolated areas (*e.g.* Looe, Rhayader, Stanhope), while others are in coal mining districts which may explain their lack of equipment as centres (*e.g.* Biddulph, New Tredegar, Tonypandy). The rest are only 4C centres. Many of these are in areas such as Wales or the Pennines, or in the area of increasing population around London. It is only fair to add that some of these places have a limited importance as bus centres. Further to this a word must be added on the 117 places included in the "urban hierarchy" which, though possessing considerable facilities, have not appeared as centres in the present survey. Many (about 65) are near larger centres, particularly in the more densely populated parts of the country where urban settlements are closely spaced, and though well equipped they are of little importance to the population outside the town itself, which is attracted by their larger neighbours served by frequent bus services. A further 15 lie on the coast and almost without exception belong to the smaller type of resort.

Therefore, although it may not be entirely realistic to correlate a town's service function in respect of the extra urban population, with an assessment of its equipment in terms of banking, shopping, entertainment, social services etc., the two are by no means unrelated. In particular the most important bus centres—say those of the 4A sub-order and above—appear to be in general those places offering the widest range of shopping facilities and other services.

In many respects the study of town-countryside relationships is one of human movements and in these bus travel plays an ever-increasing part. The amount and type of traffic into any town appears to provide a most useful index in assessing the importance and extent of its local relationships though no town can be appraised in isolation without reference to its wider setting. The background against which centres in different parts of the country have had to adapt themselves is so richly various that it could hardly be expected that any index used alone would be entirely satisfactory in providing a national yardstick. The present paper is devoted to the exposition of a method and some assessment of its value. In a later paper it is hoped to give character and meaning to the pattern of centres over the country as a whole, a study to which the various maps direct immediate attention.

[1] Smailes, A. E., *op. cit.*, p. 45.

Note.—The writer is a member of the research staff of the Ministry of Housing and Local Government but is alone responsible for the content of the above paper and his views must in no way be taken as committing his Department. The paper is an abstract of part of an M.A. thesis on "Geographical aspects of service centres in



England and Wales" (London, 1955), resulting from work carried out partly within but largely outside the Department. The writer would like to express his most grateful appreciation for the kind help and comments of Dr. E. C. Willatts and other colleagues. The permission of the Controller of H.M. Stationery Office for the inclusion of the Crown copyright maps, etc., has been obtained.

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING EXTRACT is taken from the Presidential Address delivered by Sir Roderick Murchison at the Anniversary Meeting of the Society held on 25 May 1857. It is to be found in the *Journal of the Royal Geographical Society*, Vol. 27, pp. cxcvii–cxcviii.

In bringing this discourse to a close I have now only to congratulate my associates on the steady rise which this Society has made in the estimation of the public, and on the vast accession to its members in the last few years. Commencing in a striking manner under the guidance of Admiral Smyth, and increasing during the successive Presidencies of myself, the Earl of Ellesmere, and Admiral Beechey, the augmentation has so continued, that we now nearly double the number of members at which we stood during many years.

Besides the vast augmentation of our Map Office, another distinctive feature in our recent progress has been the periodical publication of our Proceedings, which, whilst they record the doings and sayings at our evening meetings, sustain the spirit of the Society, and serve to keep the members, who have been unable to attend our meetings, well acquainted with the passing events. . . .

Whilst the masses of our countrymen, it must be admitted, are better pleased with the news of the day, than with scientific discussions, many of the topics of which we treat are so popular, as well as important, that an enlightened portion of the press merits our best thanks for endeavouring to do justice to the promotion of those geographical researches in which we are embarked. It would be truly surprising if this were not so amongst Englishmen, whose colonies extend to the Antipodes; and who have, therefore, more grounds than any other nation, for making themselves well acquainted with the surface of the earth, its productions, and inhabitants. I rejoice then to see that our numbers have so increased since my last Presidency, that adequate as we then thought the present apartments would prove for our wants, we already find that they will not by any means contain our members. Assisted, however, by Her Majesty's Government with an annual grant for keeping up a public Map Office, and enjoying a good balance at the banker's, there can be no difficulty in remedying this temporary inconvenience; and when the next Anniversary arrives, I trust that we shall be assembled in halls well adapted to accommodate us, including those ladies also who, following the example of their illustrious countrywoman, Mrs. Somerville, take a deep interest in geographical science; for there is nothing more encouraging than to see the fair sex gathering information amongst us, to be by them communicated to the sons of England.

At the same time, whilst we maintain our popularity, we must render our annual Journal as far as practicable, not merely the exponent of interesting travels, but also the index of the progress of physical and comparative geography strictly so called, since we reckon amongst our associates, men who are competent to realize every wish to which the scientific geographer can aspire.

In thanking you, Gentlemen, for your friendly support, let me say, in conclusion, that when I undertook to stand in the breach occasioned by the death of my gallant friend Admiral Beechey, I did so under the persuasion that I could not execute more than one session of labour, considering that I had other scientific and official duties to perform. Feeling, however, that I may still be able to serve you for another year, I have, in compliance with your flattering request, consented to retain that which I consider to be as distinguished and useful a post as a man of science can occupy.

PLACE-NAMES AND GEOGRAPHY

ENGLISH PLACE-NAME ELEMENTS. By A. H. SMITH. Vols. 25 and 26 of The English Place-Name Society. *London: Cambridge University Press*, 1956. 8½×5½ *inches;* lv+305 *and* 417 *pages;* 9 *maps in pocket.* 70*s*

TO ALL WHO travel about the countryside with a glimmer of curiosity, and to all who read, or even glance at, maps, place-names must always be of great, and often of tantalizing, interest. They form part not only of the English scene but of English life. Such village names as High Easter and Wendens Ambo in Essex, Ryme Intrinseca and Toller Porcorum in Dorset, and a thousand others there and elsewhere, challenge our interest; and place-names in general have attracted much speculation. Theorizing passed into scholarly enquiry as the result of the work of a number of pioneers in the early years of this century. The publication of W. W. Skeat's 'The place-names of Cambridgeshire' by the Cambridge Antiquarian Society in 1904 marked the beginning of a new approach, but it was not until 1922 that the study of place-names was put upon a firm basis in England with the foundation of the English Place-Name Society. The work of the Society, for many years under the editorship of Sir Allen Mawer and Sir Frank Stenton, constitutes one of the greatest achievements of English scholarship, upon a national basis, in recent years.

The great principle governing the work of the Society has been a recognition of the danger of attempting to explain the meaning of a name without knowing its earliest form and the sequence of changes that have taken place in its spelling. It is true that many names turn out to mean what they appear to mean. Nutfield in Surrey means "the open space with nut trees," and Weybridge, in the same county, refers to a bridge across the Wey. But only too often the existing form is no guide. Thus the frequent place-name Milton sometimes means "the middle tun" and sometimes "the tun with a mill." Wyegate, not far from the Wye in Gloucestershire, has nothing to do with the name of the river, but means "Wicga's gate," whoever Wicga was. The termination "ham" may imply "ham" (a village or homestead) or "hamm" (a meadow), and it is not always easy to distinguish between them. Or again, some names ending in "den" are derived from "denn" a woodland pasture, others from "denu," a valley. A necessary preliminary to an examination of the names of any area is therefore the assembly, for each name, of early forms from a variety of sources, printed and unprinted. The elucidation of meanings is the task of the philologist concerned with phonological changes and with the study of language and dialect. But there are other aspects to the study of place-names for they constitute one of the most important sources for the history of Britain at a period (and a critical formative period) for which other sources are relatively few, often fragmentary and always inadequate. In the same way that they concern the history of society so they concern the history of landscape, for it was places that were being named, and the characteristics of those places are often reflected in their names.

The formation of the Society was followed in 1924 by the appearance of Sir Allen Mawer's 'The chief elements used in English place-names,' a thin volume of some seventy pages intended as a guide to the more common elements likely to appear in the county volumes that were being planned. Since that time, twenty-four volumes dealing with nineteen counties have appeared; the scope of the work has also been enlarged, and the more recent volumes of the survey deal with field-names as well as place-names. A considerable body of material is thus available, and the time has arrived to take stock of the position with the future in mind. The present two volumes are the result; they run to more than 700 pages, and have been written by the present Director of the Survey, Professor A. H. Smith, who has himself already contributed studies dealing with the East Riding and the North Riding. Here is a work of the first

importance, an authoritative survey of the fruits of over three decades of exacting and meticulous scholarship for which historical geographers, like historians and philologists, are greatly indebted. Like the earlier volume, it is arranged in the fashion of a dictionary, and the elements are treated in alphabetical order. Some entries are brief and occupy scarcely a line. Other entries, for the complicated or controversial elements, fill several pages. Examples are frequently given by way of illustration (the index includes over 13,000 names), and the views of earlier writers on this or that point are discussed. An introduction of thirty-six pages discusses some general problems, and among those of especial interest are the changing meanings of some elements, and the limited distribution of others.

Broadly speaking, the place-names of England fall into four categories. First come the Celtic names. They are very frequent in Cornwall, where names like Tremaine and Pencoys incorporate the Celtic "tref" and "pen," and they are also to be found in such other western counties as Herefordshire, Shropshire, Lancashire and Cumberland; Cumberland itself means "the land of the Cymry (*i.e.* the Welsh)." Celtic place-names are also to be encountered in the rest of England; Wiltshire, for example, contains a surprisingly large number. A most interesting fact is that over England generally, the names of natural features (hills, woods and especially rivers) are Celtic; such are, for example, the Thames, the Ouse, the Trent and the Derwent. Professor Smith's map of "British Names" conveniently summarizes the evidence.

The second group—the main group—is that of Anglo-Saxon names, and Professor Smith has much to say about what we may term their stratigraphy. Names ending in "ing" and "ingham" have been regarded as indicating the earliest phase of the Anglo-Saxon settlement, but the point is now made that not all "ing" names belong to the age of migration and early settlement, and that "ing" names in general must be treated with caution; an accompanying map shows a restricted range of "ing" names together with associated evidence of the first phase of the settlement. As the Anglo-Saxons advanced westward, the word "ham" seems to have become obsolete and, at the same time, the meaning of "tun" was changing from "enclosure" to "farmstead" and then to "village"; the result is that "ham" names are more frequent in the south-east and in East Anglia, and that "tun" or "ton" names are more frequent in the Midlands. As the settlement was consolidated, there came into being the great mass of terminations that give interest and variety to our place-names—cote, ford, stede, worth and the like.

The third group is that of Scandinavian names, Danish and Norse. To this group belong such "un-English" names as Litherskew, the wood (skogr) on the slope (lithr), and Mozergh, the sheiling (erg) in the marsh (moss). A welcome feature is a map of Scandinavian parish-names. Isaac Taylor's map of as long ago as 1863, so often used in the past, is at last superseded. Many of the Norse names came via Ireland, and a separate map is devoted to Irish-Norwegian names.

Lastly come the Norman names, not so important but certainly of interest in that they give a feudal and French flavour to our maps. They include names such as Belvoir, Montacute and Richmond, and also Haltemprice (East Riding) meaning "high enterprise" and Dieulacres (Stafford) meaning "may God increase it." Then there are those place-names that embody the names of French families, *e.g.* Helion Bumpstead, Holme Lacy, Shellow Bowells and Stoke Mandeville. Another late name is that of Baldock, founded by the Knights Templars in the twelfth century. Who would have thought that it was so called after Baghdad?

Of what relevance are these investigations to the study of the English landscape? As long ago as 1863, Isaac Taylor in his classic account of 'Words and places' spoke of what he called the "geological significance" of many place-names, and one of his chapters entitled "Physical changes attested by local names" is full of interest.[1] In the next decade, William Topley's remarkable studies of the Weald made use of place-name evidence in a discussion of the settlement of the area, and the method of

[1] Taylor, Isaac, 'Words and places' (London, 1863; reprint of 1902), pp. 3 and 235–55.

his treatment anticipated much of our modern thinking about such matters.[1] Some years later, Archibald Geikie again drew attention to the value of place-names as indicative of "changes in the aspect of the country." [2] In the years since then, others, in a variety of contexts, have pointed to place-names as indicating former geographical conditions, *e.g.* J. H. Round (1899) in his discussion of the Saxon settlement in Sussex,[3] Ellen Smith (1910) in her description of the Reigate district,[4] Charles Henderson (1935) in his study of former Cornish woodlands,[5] and P. A. Nicklin and E. G. Godfrey Faussett in their essay on the place-names of Sussex.[6] Then again, other writers have attempted detailed correlations of types of names with geological outcrops. Such is the method of some of G. B. Grundy's studies, *e.g.* of the Saxon settlement of Worcestershire (1933); but, unfortunately, a number of his identifications are far from certain and some of his conclusions are open to question.[7] The method has also been used by L. W. H. Payling in his instructive study of "Geology and place-names in Kesteven,"[8] by S. W. Wooldridge (1935, 1936) in his interpretation of the phases of the Anglo-Saxon settlement in south-east England,[9] and by W. J. Arkell (1942) in his account of "Place-names and topography in the upper Thames country." [10]

The editors of the Place-Name Society have been well aware of this aspect—one might almost call it by-product—of their work. As long ago as 1911 Sir Frank Stenton drew attention to the evidence of place-names for the wooded character of northern Berkshire,[11] and Sir Allen Mawer in 1920 essayed an interpretation of the distribution of "ington" names in Northumberland and Durham in the light of the surface geology.[12] In planning the survey, it was not part of the editors' design to develop these and similar themes; it could hardly have been. But many of the county volumes from 1933 onwards have included "small maps on the scale of 10 miles to the inch" to illustrate the history of the settlement; some are of linguistic interest, others relate to the natural features and economy of the time. In Surrey, for example, we see that names with the element "chart" are restricted to the Lower Greensand outcrop with the exception of Chartham and even this lies on the light Tunbridge Wells Sand (Fig. 1). The element is derived from the Anglo-Saxon "ceart" and denotes "rough common, overgrown with gorse, broom, bracken."[13] It is with surprise that

[1] Topley, W.: (1) "On the relation of the parish boundaries in south-east England to great physical features," *Jour. Anthrop. Inst.*, 3 (1874), pp. 32–56; (2) 'The geology of the Weald' (London, *Mem. Geol. Survey*, 1875).

[2] In an address of 1887, printed in A. Geikie, 'Landscape in history,' p. 10 (London, 1905).

[3] Round, J. H., 'The Commune of London and other Studies,' pp. 1–27 (London, 1899).

[4] Smith, Ellen, 'The Reigate Sheet of the One-inch Ordnance Survey,' pp. 79–85 (London, 1910).

[5] Henderson, C., "An historical survey of Cornish woodlands" in 'Essays in Cornish history,' pp. 135–51 (Oxford, 1935).

[6] Nicklin, P. A., and E. G. Godfrey-Faussett, "On the distribution of place-names in Sussex," *Sussex Archaeol. Coll.*, 76 (1935), pp. 213–21.

[7] Grundy, G. B., "The Saxon settlement in Worcestershire," *Trans. Birmingham Archaeol. Soc.*, 53, pp. 1–17 (Oxford, 1931).

[8] Payling, L. W. H., "Geology and Place-Names in Kesteven," 'Leeds Studies in English and Kindred Languages,' No. 4, pp. 1–13 (Leeds, 1935).

[9] Wooldridge, S. W.: (1) (with D. L. Linton) "Some aspects of the Saxon settlement in south-east England considered in relation to the geographical background," *Geography*, 20 (1935), pp. 161–75; (2) "The Anglo-Saxon settlement" being chap. 3 (pp. 88–132) of H. C. Darby (ed.), 'An historical geography of England before A.D. 1800' (Cambridge, 1936).

[10] Arkell, W. J., "Place-names and topography in the Upper Thames country: A regional essay," *Oxoniensia*, 7, pp. 1–23 (Oxford, 1942).

[11] Stenton, F. M., 'The Place-Names of Berkshire: an essay,' pp. 3–4 (Reading, 1911).

[12] Mawer, A., 'The Place-Names of Northumberland and Durham,' pp. xvii–xix (Cambridge, 1920).

[13] Gover, J. E. B., A. Mawer and F. M. Stenton, 'The Place-Names of Surrey,' pp. xix and 350 (Cambridge, 1934). Figure 1 is redrawn from one of the maps that accompany this volume.

one finds the element concealed in "Chocolates" the name of a wood in Thursley parish; we meet it in the sixteenth century as *Chertelease*, compounded of "ceart" and "læs." In Essex, the "wic" names, largely along the coastal marshes, give us a glimpse of the dairying that was to become so famous in later centuries.[1] Or again, in the East Riding the elements "holmr," "kiarr" and "mersc" provide a clue to the marshy condition of much of that countryside.[2]

Of all the terminations that reflect the nature of the landscape in the sixth century, those denoting the presence of wood are the most frequent and the most important. P. H. Reaney, in the Cambridgeshire volume gives "evidence for the use of *weald* for a stretch of high forest land on the clay" to the west of Cambridge city, and extending across the border into Huntingdonshire. In the south of the county another tract of wood stretched into Suffolk and Essex; and in the Isle of Ely woodland terms are more common "than one would have suspected," [3] but perhaps not if one remembered the clay nature of much of the Isle.

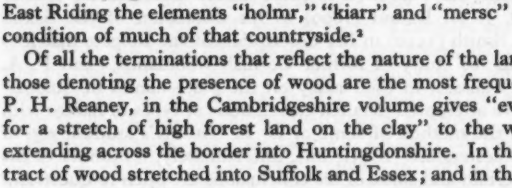


Figure 1

The full bearing of such information upon the history and forms of settlement has yet to be investigated. A clear example comes from Warwickshire.[4] Anglo-Saxon place-names ending in ley (leah) show the former presence of wood or of clearings in wood, and lie almost entirely to the north of the River Avon (Fig. 2). In spite of some five centuries of clearing there was still much wood there in Domesday times. Later documents show how the arable continued to expand at the expense of the wood, but the wood had far from disappeared by the seventeenth century. Writers of that time were able to draw a distinction between the southern part of the country called the Feldon, or open country, and the northern woodland where lay the Forest of Arden. The earliest 1-inch Ordnance Survey maps issued in the 1830's show a contrast between the south, characterized by compact villages surrounded by open country, and the north, characterized by dispersed houses, the dispersion resulting from scattered settlement proceeding piecemeal as the wood was cleared. This distinction between north and south is still important today, although industrial growth has complicated the picture. In the unravelling of the history of our countryside, and in the understanding of the features we see around us, place-name evidence takes its place as a valuable clue.

At this point it must be said that the relationship between place-name study and geographical enquiry is not that of one-way traffic. Sir Allen Mawer, time and again,

[1] Reaney, P. H., 'The Place-Names of Essex,' pp. 569 and 594 (Cambridge, 1935).

[2] Smith, A. H., 'The Place-Names of the East Riding and York,' pp. 314, 325, 326, 327 (Cambridge, 1937).

[3] Reaney, P. H., 'The Place-Names of Cambridgeshire and the Isle of Ely,' pp. xxvi–xxvii (Cambridge, 1943).

[4] Gover, J. E. B., A. Mawer and F. M. Stenton, 'The Place-Names of Warwickshire,' pp. xiii–xiv, and 316 (Cambridge, 1936). Figure 2 is redrawn from one of the maps that accompany this volume.

pointed to the danger of an exclusively philological approach to the study of place-names; and he stressed the need for a first-hand acquaintance with places as well as with their names. "The conclusions of the philologist," he wrote, "must in every case be checked by the evidence of topography derived from maps, from first-hand knowledge, or from special inquiry." [1] Local knowledge of the countryside frequently provides a clue to the meaning of a name.

It is interesting to note the use of place-name evidence in the study of geography on the continent. As long ago as 1910 Jean Brunhes drew attention to its value for the investigation of the French countryside, and referred to its rôle in Auguste Longnon's course on historical geography at the Collège de France.[2] Some years later, Brunhes described place-names as "the fossils of human geography," and gave some indication of the way in which they might be interpreted.[3] More recently, the French place-name scholar Albert Dauzat has stressed the need for "collaboration with geography, archaeology and history," and, with the aid of place-names, he has reconstructed what he calls "the primitive aspect" of Beauce.[4] In Germany, long traditions of place-name study and of investigation into changing landscapes lead us to expect that the aid of place-names would be enlisted by historians and geographers of settlement. We cannot be surprised that Otto Schlüter, for example, has made extensive use of place-name evidence in his various studies of the geography of settlement,[5] or that, more recently, G. Niemeier should have examined the problems and possibilities of the use of such evidence by the geographer.[6]

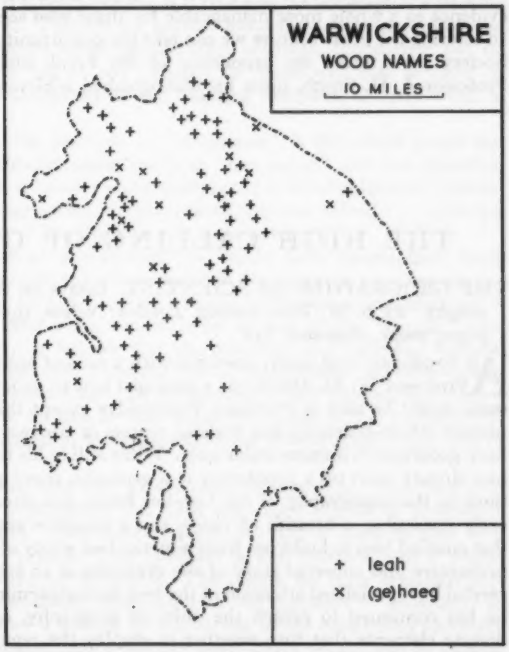


Figure 2

[1] Mawer, A., 'English Place-Name Study: its present condition and future possibilities,' pp. 6–7 (British Academy, London, 1921). See also A. Mawer, 'Place-Names: an essay in co-operative study,' p. 10 (Liverpool, 1922).

[2] Brunhes, Jean, 'Human geography,' p. 579 (London, 1920).

[3] Brunhes, Jean, 'Géographie humaine de la France,' vol. 1, p. 289 (Paris, 1920).

[4] Dauzat, Albert, 'La toponymie Française,' pp. 4, 13, 58–67.

[5] *E.g.* Schlüter, Otto, 'Wald, Sumpf und Siedelungsland in Altpreuszen vor der Ordenszeit' (Halle, 1921), and 'Die Siedlungsräume Mitteleuropas in frühgeschichtlicher Zeit,' Part I ("Forschungen zur Deutschen Landeskunde," vol. 63), Hamburg and Remagen, 1952.

[6] Niemeier, G.: (1) "Die Kulturgeographische Fundierung der Ortsnamenforschung," *Erdkunde*, 6 (1950), pp. 162–77; (2) 'Die Ortsnamen des Münsterlandes. Ein kulturgeographischer Beitrag zur Methodik der Ortsnamenforschung' (*Westfäl. Geogr. Studien.*, No. 7, Münster, 1953).

The contributions made by French and German place-name scholars have been most distinguished, and they put us all in their debt. But it so happens that in neither country is there a nation-wide survey proceeding, although in Germany a survey of Bavarian place-names is now in progress.[1] Here, in England, thanks to the pioneer effort of Sir Allen Mawer and Sir Frank Stenton, we enjoy unusual facilities for using such evidence. After over thirty years' endeavour we can begin to see the work of the English Place-Name Society in perspective, and a noble achievement it is. The voyage is far from over. Volumes for over twenty counties have yet to appear, but the recent Annual Report of the Society shows work in progress on a large number. These present volumes come at a timely moment. They not only summarize what has been done in the specialized field of linguistic enquiry, but they make the evidence as a whole more manageable for those who seek to use it in other contexts. In saluting the great venture we can take the opportunity not only to congratulate the Society (now under the presidency of Sir Frank Stenton), but also its Director, Professor A. H. Smith, upon his distinguished achievement.

H. C. DARBY

THE HIGH CALLING OF GEOGRAPHER

THE GEOGRAPHER AS SCIENTIST. Essays on the scope and nature of geography. By S. W. WOOLDRIDGE. *London: Nelson*, 1956. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xii+299 *pages; maps, diagrams.* 35*s*

AN AMERICAN GEOLOGIST, speaking with a note of envy in his voice, once said that Professor W. M. Davis was a geologist lent to geographers for their good. The same might be said of Professor Wooldridge except that he has not lent, but given himself whole-heartedly and without regrets or backward glances; geology's loss has been geography's immeasurable gain. While still in his twenties Professor Wooldridge had already built up a reputation as a geologist, more particularly for his contributions to the stratigraphy of the London Basin, but already he had brought to those early researches a breadth of vision and a sensitive appreciation of landscape form that enabled him to build up, from a meticulous study of multitudinous detail, a comprehensive and coherent story of the evolution of an area that had long received the careful but specialized attention of the best geological minds. From that time onwards he has continued to preach the unity of geography, compounded though it be of diverse elements that fuse together to display the region. The transition had been made from geologist to geographer.

The earliest of the sixteen essays included in this collection was first published in 1931, the latest in 1954; but the arrangement is not chronological and this is no mere "collected papers." The title of the book is the title of his inaugural address on appointment to the chair of geography at Birkbeck College in 1945. In it are set out the guiding principles of his working life and in the chapters that follow, going both backwards and onwards in date of delivery, we may see his consistency of aim and fidelity to principle. It is an intensely personal and scrupulously honest expression of conviction. Trained in science and deeply imbued with the spirit of objective enquiry and strictly disciplined thinking, he naturally moves with the greatest facility and makes his most impressive contribution to knowledge within the field of physical geography. Yet even the most purely geomorphological essays serve to illuminate the geography of the region as the home of man, while in others, though agricultural,

[1] The first volume of the Bavarian survey outlines the scheme as a whole, and draws attention to the value of place-names for the history and geography of settlement—'Historisches Ortsnamenbuch von Bayern,' vol. 1 (München, 1952).

historical or economic geography may take precedence in the title, the distributions described and analysed are always brought firmly down to earth and related to the terrain. In nothing does he insist more firmly, by implication or direct challenge, than on "keeping the Ge- in Geography." Furthermore it is an essential part of his teaching and practice that we must learn about the ground *on* the ground, by seeing in their entirety and in their proper context all those diverse elements and distributions that present themselves together in the region. It would be much easier to study each item in isolation, but nature, it has been said, does not take kindly to being asked questions one at a time and gives a conditional or evasive answer to each one. The whole answer to the whole question is overwhelming in its complexity; it may be hard to understand but it is sincere and it is true and the geographer's training is to comprehend her language. Though the narrow mind may envy the "blinkered seclusion" of the more straightly confined specialist scientist, the author has no sympathy for such minds, nor has he any patience for those who find in facile or superficial generalizations an alternative to the exacting discipline of hard work in the field and with the map.

The logical conclusion to the doctrine of "wholeness" is the often stated but rarely attained destination of geographical study as "the region" and this question, of vital import for our subject, is bravely and frankly faced in his Presidential Address to the Institute of British Geographers in 1951—faced, but not solved ". . . the end of our quest to see the regions of the world as wholes is not yet."

Without belittling the "special geographies" he would have geographers study regions, not problems, but, though the whole world is Geography's province no one mind can encompass it all. So let him focus on a region of limited extent, unafraid of the charge of parochialism. And since superficiality in any of the "special" geographies is not to be tolerated it follows that the complete and balanced regional geographer must equip himself with a mastery of all specialisms, an omniscience limited only in respect of its areal range. If, for reasons of his training and equipment, he *must* study problems, let him at least focus his studies in the region of his choice, regarding too much attention to "otherwhere" as a weakening dispersion of effort.

It is a stern and exacting discipline that we are asked to submit to. Academic geographers preach the ideal of regionalism and most university schools of geography demand a "regional dissertation" from their students, but few of them in their own researches practice what they preach. This criticism is well founded, but it would be an injustice to infer that they are incapable. The reason for their apparent disloyalty to the principle of regionalism, enunciated by the founders of geography as an academic discipline, is rather a waning of confidence in the continuing adequacy of a technique of study elaborated half a century ago. There would still be general agreement in this country that geography is and should be indivisible at the undergraduate level, but what is good for teaching may not be good for research and doubtless many geographers will continue to regard this whole-minded devotion to the minutiae of regional geography as trivial and the value of the rewards incommensurate with the effort. Some, doubting whether the blessed state of omniscience is attainable by one mind, however versatile and gifted, will place their vote for teamwork; but can a team have a collective mind capable of making a unified synthesis? Others maintain that regions do not exist except as chimerical creatures of the geographer's own mind and scorn their pursuit as a dalliance. Others pin their faith on the attack on a narrow front with the sharper weapon of their own well-understood specialism. *Quot homines, tot sententiae.* But Professor Wooldridge points the way with his own researches and courageously nails his colours to the mast; "we stake our claim and point our objective, not as though we had already attained, but as those still pressing towards the high calling of geographer."

Only about a third of the chapters are in the nature of research publications and even these, richly informative as they are, are presented rather to illustrate method

than for their factual content. Others were designed to stimulate rather than to inform. Often controversial in nature they are deliberately intended to shake some of the audience out of complacency and if occasionally his attack seems unsympathetic it must be remembered that they were written to be read to an audience and are deliberately provoking. They succeeded in setting tongues wagging at the time and will continue, in their printed form, to compel the reader to search his own mind and review his beliefs.

But stimulating as Professor Wooldridge's work has been to geographers and field scientists of all ages and stages from the school child at the Field Studies Centre to geomorphologists in international congress, it is to be hoped that 'The geographer as scientist' will be widely read outside the profession. For a scientist and scholar whose work has made for him a reputation in so many fields and yet so wholeheartedly professes himself a geographer is the best champion the subject could have.

A. AUSTIN MILLER

REVIEWS

EUROPE

LONDON'S COUNTRYSIDE. By S. W. WOOLDRIDGE and G. E. HUTCHINGS. *London: Methuen*, 1957. 9×5½ *inches; 223 pages; pictures, maps, diagrams.* 18*s* 6*d*

The fundamental question that geography asks is, where? And fifty years ago a majority of the educated public believed that the geographer's function began and ended there. He was a gazetteer, with accompanying maps. When Halford Mackinder declared that he should turn to the questions "why there?" and "what then?" he outraged the scientists and humanists alike, for this involved excursions into geology and history. Even at the Royal Geographical Society, where "geography" had long been synonymous with "travel," the new academic geographer was made to feel himself an outsider.

But this is past history. Wars and threats of wars created a new and tragic interest in maps and terrain. Moreover, trained geologists and historians entered the geographical field, and gave to the subject a balance and discipline which in its young exuberance it had lacked. Among these was Dr. (now Professor) S. W. Wooldridge, who had early won distinction as a geologist and was turning his attention to geomorphology—the relation of rocks and landscape. This was already well established in France as a prerequisite for the geographer. Dr. Wooldridge's name will always be associated with the London Basin, for he has devoted himself largely to the elucidation of its structure and surface features, not neglecting their effect upon human settlement. And his method, of course, is field observation. It is a method he presses upon all geographers, young and old alike, and he does so by leading them into the open. This he has done so successfully, that the demands upon his services have now become embarrassing. Scores of times he has tramped over the ground with students around him, and the book under review is intended to give younger teachers the courage (and the material) to become leaders in their turn.

Professor Wooldridge has, as might be suspected, taken a prominent part in fostering the work of the Council for Field Studies and so he has chosen for his collaborator the Warden of the field studies centre at Juniper Hall in the Mole river gap, Mr. Hutchings. 'London's countryside' falls into two parts. First of all there is an outline of the physiography, vegetation and early human settlement of the area around London, and this is followed by detailed instructions for a dozen different excursions to the south and north of the Thames. The walking distances range from 5 to a stern 12

miles, and each route is prefaced by a statement of the maps required and the means of access available from London. Points *en route* are pin-pointed on the map-grid, and if the reader is alert to follow the text he will miss nothing of geographical significance. There are some magnificent photographs, especially of the chalk scarp, but perhaps even to be preferred to these are the line drawings. These are the skilled work of Mr. Hutchings, and include landscapes, transects, geological sections and sketch-maps. The same hand was responsible for the attractive dust-cover. Both text and illustrations are of a quality to excite enthusiasm, and this moderately priced book should be on the shelves of every teacher and student of geography; or, preferably, in their hands out of doors.

E. G. R. TAYLOR

N.E.A.T.: Second report of investigations into certain solifluction and patterned ground features in Norway. *Oslo: Norsk-engelsk-amerikansk teleforskningsgruppe*, 1957. 11½×8½ *inches; 41 pages; sketch-map, diagrams, illustrations.* 5*s*

This cyclostyled report records further preliminary results of a research team led by Mr. P. J. Williams, who has been working on solifluction phenomena in Norway for three successive seasons. The earlier work has been discussed in the March 1957 number of the *Geographical Journal*. An important feature of this work is the attempt to link fieldwork on solifluction with soil mechanics. New apparatus has been used, in particular flexible metal probes with strain gauges attached which have enabled the amount, depth and time of occurrence of soil movements to be recorded with reasonable accuracy. Botanical studies were also included in the programme.

Landslips and certain related movements on natural and artificial slopes can often be explained in terms of soil mechanics. Mr. Williams realizes that the rigid mathematical analysis of the mechanics of solifluction slopes may not be possible, but he aims to further the understanding of this complex phenomenon by careful measurement of the main factors involved.

Most of the work was carried out near Snøhetta, Dovrefjell, at an altitude of 1170 metres. A ledge of a fluvio-glacial terrace, 50 metres up a steep valley side, is occupied by a seasonal snow patch which usually lasts until the late summer. Immediately downslope from the snow patch, the solifluction is little impeded by sparse vegetation, but further down the slope are small vegetated solifluction tongues with steep fronts 30–40 centimetres high. The average slope is about 19° and the basement rock, sparagmite schist, is thickly covered by transported material varying from large stones to gravel, sand and clay. The probes, thermometers and pressure gauges were laid out in an elongated area of about 2500 square metres lying immediately downslope from the snow patch and, like the latter, running parallel with the contour. Cables led to the tents for reading the electrical instruments and other readings were taken by theodolite from a distance so as to avoid treading on the ground under observation. Movement was very erratically distributed both in time and place, the maximum being 25 centimetres in the three weeks. One movement of 10 centimetres occurred in 24 hours. The most significant result was the manner in which the movement followed the thaw down into the ground, the maximum differential movement occurring immediately above the frozen layer.

Density measurements showed that the frost-heaved soils after thawing had a high void ratio and therefore a much reduced cohesive strength. On the other hand, pore-water pressure was low, presumably as a result of the long downhill drainage path, and this should increase somewhat the shearing strength of the soils. The weight of the snow patch did not appear to be an important factor in encouraging downhill movement, chiefly because when the snow was thickest the subsoil was frozen and little or no movement occurred.

Photographic recording of annual changes in soil polygons was continued. The report ends with a detailed botanical investigation of solifluction terraces, mostly at Reinheim, Dovrefjell, which should serve admirably to complete the picture of the solifluction phenomena in the area.

W. V. LEWIS

EUROPEAN REFUGEES 1939–1952. A study in forced population movement. By MALCOLM J. PROUDFOOT. *London: Faber and Faber*, 1957. 9×5¾ *inches;* 542 *pages; maps and tables.* 52*s* 6*d*

This book describes one of the most staggering social phenomenon of our times: the forced movement within Europe, between the years 1939 and 1950, of an estimated sixty million persons—six times as many as were involved in the refugee movements of the First World War. Dr. Proudfoot analyses the nature of the movement itself and describes the measures which were devised by governments and other agencies to deal with its many aspects. The author was clearly very well fitted to carry out his set task since he served during the Second World War in the displaced persons branch of SHAEF and with the United States Bureau of the Census before joining the geography department of Northwestern University, Illinois. He has sifted an immense amount of material and has traced the numerous separate movements which make up the European refugee problem since 1939. His work inevitably leans heavily on statistics which, however, he handles expertly—and revealingly. We are able from the study of his book to understand the scale, variety and effects in Europe of the unprecedented shifts of population due to refugee movements for which, in the main, the policies and power of the German and Russian governments were responsible. Further, the author has done more than measure numbers; he has at many points deftly and surely reminded his readers of the difficulties and suffering of the compulsory migrant. And the record he gives of measures taken to alleviate the hardships of refugees and to resettle them, pays deserved tribute to those many governmental and relief organizations involved.

'European refugees' largely follows a chronological sequence starting with pre-war refugee movements and then passing to wartime movements, mass care and repatriation, and to the roles of the Allied military authorities, of UNRRA and of the IRO. This sequence is broken by three chapters of special interest which are devoted to the German concentration camps (of which a distribution map is given), and to Jewish and German refugees. Other chapter headings, additional to those referred to, are "Wartime escape routes from German areas" and "Forced labour movements," *i.e.* to Germany, where 8·6 million foreign civilians and prisoners of war were employed in January 1944. At the end of the war, there were, in Germany, as many foreign workers as German, to the alarm of the latter. The movements of Germans alone have altered the nationality distribution map of Europe in detail in many areas, as a result of their westward flow and repatriation; Germany, with an area reduced by 25 per cent., had an increase of population between 1939 and 1950 of 17 per cent., despite war losses of 4·2 millions. Every sixth person in Western Germany in 1950 was a refugee.

W. G. EAST

TRAVEL IN PICTURES

A witty text makes Lord Kinross' record of a journey from Crete to Mount Athos more than just a picture book for the gift trade (PORTRAIT OF GREECE, *Max Parrish*, 1956, 35*s*). Such a portrait can be no more than a lightning sketch, but it has a solid substructure of history and mythology skilfully reduced to essentials for the uninitiated. The racy style, humorous without being facetious, is equally happy in presenting the glory that was or the utilitarian that is: Parthenon columns lighted by the sun or Heraklion streets by neon-tubing. To match this pictorially, Lord Kinross could not have had a better companion than Dimitri. His forty colour plates are not only subtle and true in tone, but taken with the same freshness of approach; never more apparent than in his treatment of an over-photographed subject like the Lion Gate at Mycenae. The 'Portrait' is a piece of lively impressionism and the author concludes with a point successfully implied throughout: that Greece will continue to survive the aneleutheria of barbarism.

VENEZIA is a free publication issued by the Commune di Venezia in an elegant

format within murrey-coloured cloth stamped with the Evangelist symbol of St. Mark in gold. It is not the microcosm that it is claimed to be in the preface, but nevertheless an impressive review of many aspects of the old Republic and the modern city. Eighteen photographers have contributed to a collection of plates (fifty-six in black and white and nineteen in colour) of which nearly all are original and many brilliant. Some of the best have been taken, it seems, from a perilously low-flying helicopter, at an angle which excites the eye to a new discernment of form and character: Sta. Maria della Salute appears set up like a bride-cake amongst gingerbread; and the figures dotting the wide pavements of the Piazza di San Marco are given their proper value of impermanence as a foil to the architecture.

The other arts are thinly represented. Here and throughout, some of the less informative camera studies could well have been replaced by subjects scoring several points in one shot. I should have liked to see the Gentile Bellini in the Venice Academy which shows the great annual Corpus Christi Procession against a background of the Basilica and Ducal Palace; or, as a tribute to the Venetian adventurers, the Mappamondo of Fra Mauro in the Archaeological Museum, setting out the sum of geographical knowledge in the mid-fifteenth century; or a view of the Sotto Piombi storey where Casanova was imprisoned: all well within the scope of the tourist public to whom the book is addressed. It is a book just missing excellence; Venice potted, but not quite Venice Preserved.

G. A. LANGDON

ASIA

ASIA: a regional and economic geography (9th edition). By L. DUDLEY STAMP. *London: Methuen*, 1956. 9×5½ *inches;* xvii+726 *pages; maps and diagrams.* 55*s*

It is now just short of thirty years since Professor Stamp's book first appeared. In the interim, Asia has assumed an importance in world affairs slightly more commensurate with her share of global population; the emergence of confident and eclectic nationalism has in large measure occupied the vacuum caused by the decline of imperialist control; and knowledge of many basic elements of the geography of Asia has greatly expanded. It is a measure of Professor Stamp's sureness of approach that his basic pattern of treatment can remain unaltered—in this revision the changes are in the main concerned with statistics, detail, and the inevitable evolution of political changes and economic trends.

For the general student, 'Asia' remains essential basic reading; and we can only be grateful to the author for the wide background which informs the wealth of up-to-date facts and statistics that have come to characterize Professor Stamp's work. One increasing difficulty in the training of present-day students of geography is that they are encouraged to develop ideas and principles sometimes at the expense of basic facts. A regional treatment like that given by Professor Stamp can be a valuable corrective.

The best chapters are perhaps those on the Indian sub-continent. Here a successful balance is achieved between the cultural, economic and political aspects of the topic. Understanding of economic problems necessarily involves some reference to race and religion, but the complexities of these latter tend to militate against their inclusion in a geographical text. The succint but highly informative presentation of developments since partition are also of much interest and value.

In a work of this kind, it is always possible to level criticisms in matters of detail or of approach. To cover the world's largest single land mass in one volume is to invite queries as to the correctness of treatment over regional detail, or concerning interpretations of theory. First-hand knowledge of the area can go far to counter much difficulty—though by no means completely; and it would be ungrateful to comment on such points where they occur in Professor Stamp's volume. Rather less satisfactory, perhaps, is the lack of modern detail on much of Soviet Asia: many authorities cited are still those of the 1920's, but this may underline the general lack of up-to-date

material from Soviet sources. In a work specifically stated to follow a regional and economic slant, physical and structural aspects cannot be expected to bulk large—though some reference to later views such as those of Umbgrove might have been useful. These are, however, incidental matters. The value and appositeness of Professor Stamp's work are abundantly clear. W. B. FISHER

EXPÉDITION EN ARABIE CENTRALE. By PHILIPPE LIPPENS. *Paris: Adrien Maison-Neuve*, 1957. 9×5½ *inches; 214 pages; map and photographs*

'Expédition en Arabie Centrale' is an account of the travels and experiences of a Belgian Archaeological Mission in Saudi Arabia in the cold weather of 1951–2. The party consisted of Canon G. Ryckmans, Professor of Semitic languages at Louvain University, the author, M. Philippe Lippens, an expert in the sketching and photographing of ancient remains and inscriptions, and the Canon's nephew, M. Jacques Ryckmans, author of a thesis on the dynasties ruling in the south of the Arabian Peninsula before the advent of Muhammad. Professor Ryckmans and his nephew devoted themselves mainly to the archaeological work of the expedition while the author, in addition to being its official photographer, was its organizer, chronicler, naturalist and doctor. It was nursed throughout its stay in Sa'udi Arabia by Mr. H. St. J. B. Philby who interested himself particularly in the geographical side of its explorations. An excellent map at the end of the book has been copied from maps prepared by the Society's draughtsmen from his observations. The expedition travelled from Jiddah via Abha to the Najran Oasis and back via Dam to Riyadh, a total distance of 5448 kilometres of which more than 2000 kilometres is claimed as not having previously been covered by Europeans. Copies were taken of about 12,000 "Himyarite" inscriptions, doubling the number hitherto recorded. Professor Ryckmans is to publish details of these in due course and the present book is a chronicle of the expedition's daily activities intended for the general reader. It is reminiscent at times of Xenophon's Anabasis—today we drove 73 kilometres and saw two rats and a fox and a mountain covered with pink and yellow rocks—but it is lightly and humorously written and there are in particular amusing descriptions of Mr. Philby's exasperation with guides who failed to give precise replies to his enquiries about the names of geographical features. The illustrations are excellent, and include some coloured plates of outstanding beauty. W. R. HAY

SULTAN IN OMAN. By JAMES MORRIS. *London: Faber and Faber*, 1957. 9×6 *inches; 165 pages; illustrations.* 16*s*

It astonishes one that when the first gusher of oil came to the surface at Burqan in Kuwait, twenty years ago, and when a few years later more oil-pools were located along the Arabian seaboard of the Persian Gulf, every little Sheikhdom and every principality in the vicinity did not immediately settle once and for all their undefined boundaries, and "peg out their claims." If they had done so a lot of prolonged argument and trouble might have been avoided. But if this precaution had been taken, we should not have had this excellent account of an amusing expedition which the Sultan of Muscat and Oman was forced to make in order to establish his rule, at long last, over a portion of his territory of which he ought to have been master long ago. After an advance Field Force had made sure of the fortress of Nizwa (which capitulated without firing a shot although it was full of recently smuggled rifles and ammunition) the Sultan set out to establish his rule over the hinterland of his Sultanate. From his little private Dafur paradise he made a grand tour, by car along the western marches for 700 miles—a sort of royal procession over a region which had never heard the "hoot" of a motor, nor seen armed men in trucks. Continuing to Buraimi, the debatable, where the Sultan's territory borders with that of the Sheikh of Abu Dhabi, there was a friendly meeting between these two—the only possible claimants to this poor little place. Mr. Morris accompanied this strange border "show" as war correspondent for a London newspaper, and as such tells the

story of it in the vernacular: a racy account of what constitutes a "scoop"! The book should be read in conjunction with Thesiger's excellent map of the region (*Geogr. J.*, March 1951) and with Dr. Kelly's summing up of the Buraimi controversy in *International Affairs*, July 1956. DOUGLAS CARRUTHERS

NO PASSPORT TO TIBET. By F. M. BAILEY. *London: Hart-Davis*, 1957. 5½×9 *inches; 294 pages; maps and photographs.* 25*s*

This latest book by Colonel Bailey is another invigorating delight. His original report on his 1913 journey was, so he says, sternly concerned with facts that would be useful to the Government of India, and so would save him from a reprimand for having gone ahead before cramping instructions could arrive. A conference with the Chinese and Tibetans was being staged at Simla where there was nervousness about risk of incidents. He and his "imperturbably adventurous" companion Morshead had plenty of risky moments but avoided troubles that might have been officially awkward, and they earned high praise for clearing up much vagueness about that frontier corner and about the great Tsangpo–Brahmaputra flow, which was one of the problems that had always intrigued Bailey.

It is fortunate for us that his diaries, written in most difficult conditions, can now tell also of many human incidents and show how well he was equipped—except with kit or passport—to explore among strange people and places. This survey of what still remains an extremely fascinating and inaccessible area brought new knowledge of animals, birds, butterflies, flowers, mountains and rivers, and it included the discovery of Gyala Peri as a separate mass of nearly 23,500 feet, and of minute specimens alike. If the use of a richly stored memory has given pleasure to the author, maturity has not lessened its freshness for others. Like the pilgrim he met in tough days, he seems to have found there more of spiritual ease than physical discomfort.

Days were tough indeed and the two officers kept on the move almost continuously during those six months, despite sickness and the torrents and other deterrents of that hard country. A main bother was the getting of fresh porterage at most villages, and it was by persuasive talk and not by any passport that the Tibetans were induced to concede the "Ula" help of free transport; in that ill-knit land a modest-looking party had to rely on personality to get this oft-changing service, or even any food. As Colonel Bailey philosophically writes, "As we went, we mapped, we waited for Ula, we got angry when it looked as if being angry would be effective, and sometimes when it wasn't." In the Himalaya a man's foot has to be a most precious part of the body and when a Lopa porter's foot was touched by accident on the journey a general fight was nearly the result, but through such stresses wise patience was obviously in control.

Readers of this *Journal* need no reminder of the award of the Society's Gold Medal after the journey, or of the fuller records of both Colonel Bailey and the splendid friend who was with him; they are likely to need, however, the refreshment of this good tale and of its final hopeful note. CHRISTOPHER SUMMERHAYES

AFRICA

LAND USE STUDIES IN THE TRANSVAAL LOWVELD. By MONICA M. COLE. The World Land Use Survey Occasional Papers No. 1: series edited by L. Dudley Stamp. *London: Geographical Publications*, 1956. 11×8½ *inches; 41 pages; maps, illustrations, diagrams.* 5*s*

A great deal of research will be needed before a relatively clear picture can be obtained of the physical environment of the world's savannah regions. Miss Cole has tended to specialize in the geography of such regions, and this paper is a valuable contribution to their study. European settlement in the Transvaal Lowveld has only

developed recently after much pioneer effort, and Miss Cole has made a geographical study of land use in this area, particularly in the Crocodile–Komati drainage basin. The Transvaal Lowveld lies at an altitude of less than 3000 feet; the physical background is difficult, with great variations of temperature and rainfall (summer maximum), limited opportunities for irrigation and lateritic soils. A wide variety of crops is produced; citrus is the most important, the Crocodile–Komati valley being one of South Africa's main producers of this fruit. Other fruits such as mangos, papaws, avocados, guavas granadillas and bananas, and crops such as cotton, tobacco, groundnuts and maize are grown, with vegetables where rail facilities are good. Away from the river valleys only extensive cattle ranching can be carried on.

The area offers considerable contrasts in agricultural economy, varying from subsistence farming in the upper Crocodile valley to a very large citrus plantation—the Letaba Estates. Future development is dependent on the solution of problems such as the adequacy of water supply, the necessity for more detailed climatic records, high phosphate-fixing capacity of the soil, and the usual difficulties of marketing, transport and lack of capital. There are opportunities for much greater development along all the perennial rivers, except the White River. A study such as this illustrates the many environmental difficulties to be solved and the amount of research that is needed before settlement and intensive agriculture on a large scale can progress in a tropical or sub-tropical region. The text is well supported by thirteen detailed land use maps and many other illustrations and diagrams. N. C. POLLOCK

NORTH AND CENTRAL AMERICA

THE NATURAL RESOURCES OF BRITISH COLUMBIA. Edited J. D. CHAPMAN and D. B. TURNER. *Victoria, B.C.: British Columbia Natural Resources Conference*, 1956. $9\frac{3}{4}\times7$ *inches; 571 pages; maps, diagrams, tables and illustrations.* $7.50

This record of the transactions of the Ninth Annual Conference devoted to the study of the natural resources of British Columbia contains the most complete survey available of the rich and varied inheritance of that Province. It is, however, not only an inventory but an evaluation of past, present and future trends in the development of those resources, bearing in mind throughout the importance of conservation and the interdependence of their development. This factual analysis and objective assessment is achieved in some three dozen papers contributed by experts in their respective fields drawn from industry, university and government. Each section stands by itself as a most useful, authoritative and up-to-date treatment of the Province's physical and human endowment, and they will serve both as basic source material for further research and as a reference book for students, teachers, business men and all general readers interested in the regional geography of Canada at all levels. A companion volume 'The British Columbia atlas of resources,' published simultaneously, apparently complements in cartographic form the material provided in the transactions; a review appeared in the *Journal* for June 1957.[1]

While all the papers are not of equal merit or significance, geographers will be especially interested in those dealing with the demographic patterns of the province, the excellent analysis and evaluation of its soil resources, well illustrated and presented with perceptive regard for distributions and origins, and the full accounts of fisheries and forests. An introductory chapter on past trends and a concluding summary reviewing the economic outlook go some way towards providing the setting and synthesizing the content of the papers read at the Conference. The verbatim reporting of chairmen's introductory remarks and conference announcements, plus photographs of all the contributors, seem unnecessary and rather spoil the volume.

[1] The second editor of the atlas is D. B. Turner, not D. B. Lewis as stated in this review.—*Ed.*

The reports of discussions, on the other hand (although again unnecessarily verbatim), do much to bring out useful additional points on the subject under consideration.

Although since 1931 the population of British Columbia has doubled and there has been a phenomenal expansion in electricity and paper pulp production, it would seem that in three of its basic primary industries, agriculture, mining and fishing, a decline *per capita* is in process. The fundamental analysis of these relative trends, in the part of Canada which is showing greatest post-war dynamism, is of vital concern to those who wish to keep abreast of the factors underlying the increasing interest being displayed in the region. The sponsors of this volume are to be congratulated on the whole concept of such a conference, where ideas on wise and planned regional development can be pooled for the benefit of all. G. J. BUTLAND

THE CLIMATE OF BRITISH COLUMBIA AND THE YUKON TERRITORY. By W. G. K. KENDREW and D. KERR. *Ottawa: Edmond Cloutier*, 1955. 9×6 *inches; 222 pages; illustrations, charts and tables*

This volume is in two parts, the first on southern British Columbia, and the second on northern British Columbia and the Yukon Territory. The highly complex mountainous relief of this region and the exclusion of Pacific influences from the interior by the Coastal Range with rapid increase of continentality eastward, lead to pronounced local irregularities of climate. These are portrayed with all the lucidity so characteristic of Mr. Kendrew's works. Whereas many of the western slopes of the coastal mountains have an average annual rainfall well over 100 inches, some of the inter-montane basins in rain-shadow receive no more than 20 or even 10 inches, so that irrigation is necessary. There are marked differences in rainfall even between the two sides of Vancouver Island.

Of particular interest is the Yukon whose climate continentality is much enhanced by the shutting out of oceanic influences by the high St. Elias ranges with their vast glaciers. The Yukon Territory contains a "frost-hollow" named Snag where on 3 February 1947 a minimum of −81° F. was recorded; the lowest, that is, ever recorded in Canada or the New World and not far short of the world record of −94° F. in the celebrated Verkoyanks hollow in north-east Siberia. Yet at Snag the temperature has risen to 88° F. in summer and to 95° F. at Dawson. It is pointed out that whereas in most of Canada August, owing to the normal effect of thermal lag, is decidedly warmer than June, in the high-latitude continental climate of the Yukon the advantage is definitely with June because of the long days and the high solstitial sun. This is the more striking because much snow remains to be melted in June. The volume is embellished by excellent photographs but the inclusion of a relief map of the two areas combined would have been useful. L. C. W. BONACINA

CALIFORNIA AND THE SOUTHWEST. Edited by CLIFFORD M. ZIERER. *New York: Wiley; London: Chapman and Hall*, 1956. 10½×7¾ *inches;* x+376 *pages; maps, tables and illustrations.* $11.25 (90s)

The Midwest and California are probably the two major regions of the United States which have acquired greater relative significance in the nation during the twentieth century than any other section. It is fitting, therefore, that each has now received attention by the publication of new and complete text-books devoted to their regional geographies. The volume relating to California and the Southwest is the work of thirty-one specialist authors under the editorship of Professor Zierer of the University of California at Los Angeles, who has also contributed the introductory chapter and most valuable sections on transport, foreign trade and seaports.

It is without doubt the most comprehensive treatment of this part of the United States that has yet appeared. One quarter of the book is devoted to the physical characteristics of the region, and the remainder to its cultural features. Within this systematic arrangement each paper, be it land form divisions, the period of Indian settlement or urban water supply and power, stands as a separate and individualistic

study of one aspect of this great area. These studies are illustrated with a wealth of maps, photographs, tables, and lists of the more important basic references relative to each subject treated. It can thus be used both as a work of reference and as an advanced regional text-book, conveying an accurate analysis of the landscape and its human utilization. This is done within a physical and historic framework, but emphasis is placed on present-day conditions to give a mid-twentieth century picture. Especially is this true of the treatments accorded to agriculture and the manufacturing activities connected with motion pictures, radio, television, motor cars, aircraft and iron and steel, which provide up-to-date material essential to an understanding of many facets of such a dynamic region.

Difficult as it would have been, one feels that a concluding synthesis, based on the preceding chapters, endeavouring to assess the significance of California and the Southwest in its national setting, would have been an invaluable addition to a volume which is otherwise wholly, and at times excessively, analytical. This latter defect of almost note-form cataloguing of resources, with little or no relationship to regional, physical or cultural distributional patterns, makes parts of the book dull and ungeographic, but elsewhere it is relieved by imaginative sampling methods as utilized in the chapter on climate, or by broad syntheses of regional patterns so well developed in the account of rural life in the area.

G. J. BUTLAND

THE WINDWARD ROAD. Adventures of a naturalist on remote Caribbean shores. By ARCHIE CARR. *London: Robert Hale*, 1957. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 223 pages; illustrated.* 18*s*

The author, Professor of Biological Sciences at the University of Florida, gives an entertaining account of travels along the beaches of the Caribbean, primarily with the object of studying the habits of sea turtles. It is curious that practically nothing is known of the breeding habits and natural history of Kemp's turtle *Lepidochelys kempi*, commonly known in America as the Ridley. This species occurs all along the coast from Fernandina to Key West and out to Pensacola but for some unaccountable reason it has not been found in the Bahamas or Bermuda, nor even in the Caribbean. The majority of specimens have been caught off the Florida coast and along the Gulf Coast to Texas, and are swept along in the Gulf Stream and occasionally reach the British Isles. Although the author has travelled widely in his search for their breeding haunts, the mystery remains unsolved. The breeding habits of two other species which lay their eggs in the sandy beaches are described and the methods used for catching the adults. There are also accounts of many other curious animals including a group of nine Gray's three-toed sloths which lived in a clump of twenty-eight Ficus trees in a square in the middle of Parque Vargas, Costa Rica. These sloths are called "Lively Petes" by the local inhabitants and this small colony seems to have persisted for at least sixty years.

Whilst this book is intended primarily for the naturalist, it contains descriptions of the life and customs of the inhabitants of the comparatively little known coasts of Costa Rica, Nicaragua and other parts of the Caribbean and can be recommended to geographers for its more general interest.

EDWARD HINDLE

PHYSICAL AND HUMAN GEOGRAPHY

LES MÉTHODES DE LA MORPHOLOGIE. By P. BIROT. *Paris: Presses Universitaires de France*, 1955. $9\frac{1}{2} \times 7$ *inches; 175 pages; diagrams.* 700 *frs*

Professor Birot can always be relied upon to produce stimulating and thought-provoking work and 'Les méthodes de la morphologie' is no exception. Despite its title, this book is largely a philosophical discussion of the present stage in the development of geomorphology with suggestions for new lines in research, rather than a practical handbook of morphological technique. Much of the book is unintelligible without a background of current French and German work in the subject. This book

is fundamentally an attempt to assess and defend where possible the ideas and methods used in the cyclic analysis of land forms; it suggests new ways of overcoming the only too apparent failings in our present methods, ways which it is hoped will reconstitute what has up till now been a fertile concept.

Critics of the now classical concept of cyclic analysis tend to emphasize, first, that the processes of peneplanation as envisaged by W. M. Davis do not apply exactly to warm climates, which are precisely those most favourable to the working of erosion processes; and secondly, that the geological evidence does not support the idea of long periods of stability in the earth's crust, which are implied by the development of the cycle of erosion. On the first point, Professor Birot maintains that the work now being done in warm climates, indicating that slopes evolve following variable laws according to the climates, does not invalidate the cyclic idea. He is on less firm ground in dealing with the second point, but he asserts that much evidence, notably that from isostasy, suggests that long periods of stability can occur.

Such discussion forms the setting for the main contributions of the book. The evidence of the erosional land forms themselves is examined and abuses and limitations in the techniques of cyclic analysis are pointed out. Morphometric methods now being developed in France and in the U.S.A. as a means of overcoming many of the problems are briefly discussed. Most important of all, new tools recently developed by both geomorphologists and soil scientists are considered in some detail. These new tools are grouped under the heading of "Formations corrélatives" and include the study of fossil soils, the variation of soils and sediments with climate, and the interpretations of sedimentary series formed in subsiding basins ("sédimentation inverse").

The suggestions for future research are discussed as studies in regional morphology and as studies in the processes of erosion and alluviation. The fact that Professor Birot gives more space to the consideration of processes does not mean that he underestimates the importance of regional studies and he constantly stresses that work on regions must go on side by side with analytical research into processes.

The main groups of factors which have affected the genesis of present day land forms are considered in a long conclusion. Tectonic movements, variations in the level of the oceans, and climatic variations are dealt with in turn. The geomorphologist must always be aware, in explaining his phenomena, of the many possible interpretations. Professor Birot's own conclusion is that the history of the relief of the earth ". . . est celle du couple antagoniste tectonique-érosion, et les changements climatiques n'introduisent que des variantes dans ce thème fondamental." This was said in not so very different words by Walther Penck in 1923. The story of what has happened to the study of land forms in the meantime is an interesting phase in the history of our science.

M. M. SWEETING

CLIMATE AND ECONOMIC DEVELOPMENT IN THE TROPICS. By DOUGLAS H. K. LEE. *New York: Harper and Brothers for the Council on Foreign Relations*, 1957. 8½×6 *inches; 182 pages; maps and diagrams.* $3.50

This is a good little book. Its author was formerly Professor of Physiological Climatology at Johns Hopkins University, and his book grew out of a study group organized by the Council on Foreign Relations; it brings together within a modest compass the results of a great deal of recent enquiry, much of which is otherwise only available in scattered periodicals and all of which is of vital importance to geographers and others interested in the problems of the Tropics. Professor Lee presents a series of well-written chapters on such subjects as crop production, animal husbandry, human health and efficiency, and industry. The chapter on animal husbandry is of particular value, largely because it summarizes a great deal of the author's own work and because its content is, on the whole, less familiar to British geographers. The chapter on human reactions to tropical conditions is also of great value, if only because it serves to dispel many still current myths on the subject; the author concludes (page

124) "The idea that man, who is physiologically a tropical animal, does not 'do well' in the tropics, even when infectious disease is controlled and adequate nutrition ensured, is very largely tied up with a failure to realize that civilization, as we speak of it, is a product of temperate climates and must be modified before it can induce optimum efficiency in a tropical setting." Professor Lee rightly lays great emphasis on the need for research into all aspects of tropical problems.

The book, good as it is, is by no means perfect. It suffers from some unevenness of treatment: as might be expected, sections on biological considerations are more adequate than those on such subjects as soil, and biological factors (*e.g.* in their effect on monocultures) are somewhat overstressed. The initial statement on tropical climates and the maps of tropical climatic regions will fail to satisfy many students of the Tropics. There is some tendency (which the author does, however, recognize) to confuse the effects of a non-Western society and an under-developed economy with the effect of climate, and for a discussion of climatic effects to become a general essay on under-development. And, finally, the book lacks an index. B. H. FARMER

BEITRÄGE ZUR GESCHICHTE DER ERKENNTNIS DES ERDMAGNETISMUS. Publications of the Swiss Society for the History of Medicine and Natural Science, XX. By HEINZ BALMER. *Aarau: Verlag H. R. Sauerländer*, 1956. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 892 *pages; plates and maps*

The latest publication of the Swiss Society for the History of Medicine and Natural Science is not only characteristically accurate and thorough but has also been written with an agreeable charm and freshness of literary style. To this, the occasional use of the first person contributes not a little. Primarily a work of reference, the book nevertheless readily arouses the interest of the casual reader, momentarily in search of reliable information. Any initial misgiving at the size of such an exhaustive and scholarly compilation is soon dispelled when one senses the author's enthusiasm. In any case, the size is due in large measure to the copious aids to speedy reference which are a valuable feature of the preparation of the book.

The book is well arranged for easy access to the very considerable amount of material which it contains. At the beginning is a contents list, with the title of every chapter and section. Then follows a list of original translations, grouped by language of the source and chronologically arranged within groups. Then a list of figures and plates arranged in two ways. The first is in the order in which they occur in the text and the second is classified according to subject, for example, instruments of different types, maps and so forth. Each entry in the second list includes a full description, which is an ingenious way of solving the problem of finding sufficient space for a full-page reproduction as well as an adequate commentary. The main text is divided into three parts. The first is an historical narrative (pp. 27–230) divided into three sections of six chapters each, spanning the period from the Han dynasty to Faraday. The second part is devoted to individual contributions (pp. 231–520) and contains translations (into German) of many important classics of geomagnetism, such as the Peregrinus letter and selections from Gilbert's 'De Magnete . . .'. Commentaries are made on other works, for example Mercator's world-map and Halley's 'Sea-chart . . . shewing the Variations of the Compass.' The third part (pp. 521–79) consists of three compilations on topics which specially aroused the author's curiosity, the belief in a "magnetic mountain" as the source of attraction of the compass needle, the anticipation of a magnetic telegraph (which dates from 1589) and the development of geomagnetic studies in Switzerland. Finally, there is an extensive bibliography, from which it appears that many original MSS. have been consulted and a full critique is given of all other important sources. An alphabetically arranged set of biographical notes and indexes of names and of subjects complete the book.

The work apparently began as a dissertation to the Geographic Institute of the University of Berne and one must be grateful to Professor Gygax for having encouraged Dr. Balmer to expand and publish his work. Both the author and the Swiss

Society for the History of Medicine and Natural Science are to be congratulated on producing what will undoubtedly become a standard work. R. I. B. COOPER

ALLGEMEINE MEERESKUNDE. By GUNTER DIETRICH and KURT KALLE. *Berlin: Gebrüder Borntraeger*, 1957. 9×6 *inches; 492 pages; maps and figures. DM 56*

The science of the seas properly began with the publication of the massive series of reports of the Challenger Expedition (1872–6). It was only after the return of H.M.S. *Challenger* that this science was given the name oceanography. Since those times oceanographers have been learning more and more of the physical and biological aspects of marine science. Most of these studies are in the form of reports, which now fill a substantial library.

While there are few books on oceanography, those published have nearly all been valuable guides to the subject. Of the larger works in English, special mention must be made to 'The depths of the ocean,' by Murray and Hjort (1912) and to the more recent 'The oceans' by Sverdrup, Johnson and Fleming (1942). In German there have been Krümmel's 'Handbuch der Ozeanographie' (1907) and Schott's 'Geographie des Indischen und Stillen Ozeans' (1935) and 'Geographie des Atlantischen Ozeans' (1942).

This book by Professors Dietrich and Kalle, of the German Hydrographic Institute and Hamburg University, is a worthy successor of those mentioned above. They have written it not only for specialists, but also for geographers, physicists, chemists and biologists. There is an introductory chapter on the structure of the sea floor, followed by chapters on the physico-chemical properties of sea water, methods of investigation, heat budget of the ocean, distribution of temperature, salinity, density and sea ice, geochemistry and biochemistry, theory of ocean currents, surface and internal waves, long waves, and regional oceanography.

'Allgemeine Meereskunde' is a well produced, easily handled book, with a full series of excellent text figures and plates and many references to the literature. Clearly a book of some 450 pages cannot be such a "mine of information" as is 'The oceans' (with more than 1000 pages). But since the publication of the latter work, there have been many new developments and much of this recent work is incorporated in 'Allegemeine Meereskunde.' Scrutiny of the lists of references soon reveals the rapid growth of marine physics since the last war. Marine biologists will probably feel that their side of oceanography is given too little space. (There is hardly any reference to the many relations between the physical structure of the ocean and the distribution of life). But all who study the seas, and have a working knowledge of German, will find this to be an important book. N. B. MARSHALL

THE VOYAGE OF THE *PETULA*. By FRANK EVANS. *London: Robert Hale*, 1957. 8½×5½ *inches; 189 pages; plates. 16s*

The science of oceanography for many years has been based on the work of large, powered research ships, and for investigations close to the surface these have many disadvantages. It is impossible to make direct observation of any marine life except in calm weather and a ship discharging water from its condensers is altering the temperature even if only slightly. Moreover, fishes are able to detect the low frequency vibrations of the propeller and may be affected by them. With the object of obtaining more accurate observations of life at the ocean's surface, two marine zoologists at Queen Mary's College, London, and a meteorologist, organized an expedition, and were fortunate in obtaining generous financial support in Belgium through the good offices of Professor V. van Straelen. They travelled from Dakar to Barbados in a 12-ton yawl, towing a specially built raft of carley floats, and were successful in completing the voyage in about three months. Their collections and observations are likely to be of considerable interest and are now being studied. The book under review, however, is merely another of the many accounts of sailing in small craft.

What is worse is the style in which it is written, page after page being devoted to descriptions in schoolboy slang, of the usual experiences with wind and waves. The author has wasted the opportunity of presenting what might have been a most interesting story of a new and successful method of marine observation.

EDWARD HINDLE

MERMAIDS AND MASTODONS. By RICHARD CARRINGTON. *London: Chatto and Windus*, 1957. 8½×5 *inches; 251 pages; plates and drawings.* 25*s*

In his preface, Mr. Carrington says that his aim in writing this book is to bring together "some of the more unusual and romantic facts" of those branches of natural science that interest him most. Actually the title does not quite cover the four parts of the book: "Behind the legends," "Stone testament," "Living links with the past," and "The death of races." But this hardly matters, for Mr. Carrington has written very well and has taken the trouble to go to original sources for his facts. The book will entertain and inform anyone with an interest in natural history. Students will also find here the background to some of the bare facts of the text-books, and also a fairly extensive bibliography.

Mr. Carrington's titles for the four sections of his book need a little elucidation. The first deals with the natural history of mermaids and monsters, while the second and third are concerned with fossils, both living and dead. The last section is about some of the havoc wrought by man in the natural world. Are we also incapable of learning from natural history? Lastly, 'Mermaids and mastodons' is not only well written, but also well illustrated; the figures include some specially (and attractively) drawn by Maurice Wilson.

N. B. MARSHALL

TOWN-BUILDING IN HISTORY. By FREDERICK R. HIORNS. *London: George G. Harrap*, 1956. 10×7½ *inches; 443 pages; plates and plans.* 65*s*

SOCIAL CHARACTERISTICS OF URBAN AND RURAL COMMUNITIES, 1950. By OTIS DUDLEY DUNCAN and ALBERT J. REISS, Jr. *New York: Wiley; London: Chapman & Hall*, 1956. 6×9 *inches; 421 pages; diagrams and tables.* 52*s*

Both these books are concerned primarily with towns: Mr. Hiorns gives as his subtitle, "an outline review of conditions, influences, ideas, and methods affecting 'planned' towns through five thousand years." The second work claims, with justice, that it "offers a complete, up-to-date, statistical comparison of the different sizes, types, and locations of American communities." Though vastly different in scope and method, each deals with certain basic problems of town and countryside, Mr. Hiorns in an historical context and the American authors in a contemporary setting. The first work has much to say on how to build a town as well as "how not to" and the second, by design austerely factual, shows the demographic features of towns, suburbs and rural areas in the United States.

Neither book deals with the administrative structure of towns thoroughly, though each faces the problem of separating rural and town communities. This separation must not be taken for granted: Mr. Hiorns points out that in the medieval cities of Italy agriculture was the main industry, and adds (p. 112) that "the effects of congestion are far less likely to affect adversely relatively small towns in close association with open country than the internal congestion and squalors of the sprawling industrial cities of today." Possibly the splendid planning of these medieval towns, their adaptation to a variety of sites, their cohesion within walls, their fine central piazzas, all contrive so to charm the author that he takes an optimistic view of the housing conditions of individual families. Even so, the sardine-packing of a family of nine in a Glasgow one-room tenement (p. 324), by no means an isolated case, highlights the problem of the modern city: as in so many books by planners, there is an element of "look on this picture and on this." Hard things are said of London but the book also includes a fine appreciation of the city's distinguished eighteenth century squares, places and roads.

Duncan and Reiss draw attention to the difficulty of deciding which "communities"

are towns and villages. They say at the outset that any study of rural and town populations can only be fruitful if each is related to the other, but they record also that there are many areas where an increasing interpenetration of the two types may be seen—for these areas, they suggest the term "ruraban." It would perhaps be churlish to cavil at such terminology: much more important is the recognition that "perhaps one tenth" of the population of the United States is "neither strictly urban nor rural." Has it the best qualities of both? Or the worst? This the authors do not try to tell us: their purpose is to relate the census statistics to the rural population, to towns of various sizes from 2500 upwards, with groupings defined at 3,000,000, 1,000,000, 500,000, 250,000, 100,000, 50,000, 25,000, 10,000 and 5000: not all these can be used in every table owing to the exigencies of the census material. To give one example, the authors find (p. 109) that many of the "villages" with less than 2500 people, especially but not exclusively the larger ones, resemble in demographic character the small towns of 2500–10,000 people: they cannot unfortunately separate out the towns of 2500–5000 inhabitants, with which, they think, the demographic similarity of the villages is closest.

Suburbs, the American authors show, can only exist in relation to other communities, and "in the usage of most writers" denote "an urban place (usually . . . unincorporated) outside the corporate bounds of a large city, but either adjacent to the central city or near enough to be closely integrated into the economic life of the central city and within commuting distance of it" (p. 117). Clearly this meaning is different from that common in Britain, a comment underlined by the statement that there are "even suburbs . . . completely enclosed by the central city." But as in Britain, the "rural-urban fringe" consists either of expanding towns and villages near a city, or town housing spread through rural areas. What then is Chicago? Its SMA (Standard Metropolitan Area) has nearly 5,500,000 people within a radius (in fact of half-moon shape) of 50 miles from the centre. In practice, the most densely settled area is within 10 miles of the centre, the "suburban and fringe" population within 10–25 miles and the "satellite" group, numbering 423,000, within 25–50 miles. On p. 150, the authors note that "for fringe studies it might be desirable to determine rural-urban status on the basis of workplace rather than residence."

Many other interesting points are brought out in both these books. The Americans show that efforts to attach a single label to a city are futile, for all have a variety of functions: at the same time, a strong wholesale trade centre will have good transport, and a place conspicuous for its retail trade will have good facilities for entertainment and recreation. Manufacturing cities show a variety of other functions, especially of a trading nature. And the authors draw our attention to the two areas with the highest proportion engaged in entertainment and recreation: Culver City 11·6 per cent. and Beverly Hills 11·3 per cent. Throughout, the Americans demonstrate what exists, but Mr. Hiorns also shows what might exist in some gloriously planned future. There may still be congregations which stand up after the sermon to sing "These things shall be! A loftier race than e'er the world hath known shall rise!" Mr. Hiorns' sermon seems to prepare the way for such sentiment: but he is surely right in his demonstration that the living conditions of many thousands of our townspeople are intolerable.

The two books differ markedly in their illustration. Neither is written by a geographer, but Mr. Hiorns includes some excellent plans and much of the story is told by photographs. Duncan and Reiss have a large number of diagrams and statistical tables, and three maps taken from the Census, of which that on Chicago (p. 138) is useful. Both books are expensive and Mr. Hiorns would with advantage have saved a little space by the omission of the pages of uplift drawn from sources as diverse as Psalm 122, and the works of Aristotle, Charles Dickens, W. G. East and Sophocles.

T. W. FREEMAN

MAN-MILIEU RELATIONSHIP HYPOTHESES IN THE CONTEXT OF INTERNATIONAL POLITICS. By HAROLD and MARGARET SPROUT. *Center of International Studies: Princeton University*, 1956. 10½×8½ *inches;* 101 *pages*

In this short but thoughtful essay Professor and Mrs. Sprout attempt to discover how far the capabilities, activities and relations of states can be attributed to environmental facts. They point out how, in contrast to the recent past, much effort is now directed by the United States government to the gathering and analysis of facts about other lands and peoples, on the assumptions that such research enriches its own "intelligence" about the likely behaviour of foreign governments and the likely capabilities of foreign states, and thus helps it to conduct its own foreign affairs. All this environmental information clearly provides knowledge of international situations or problems, and in some degree enters into policy decisions. These are made under the specific environmental conditions of the time by individuals who may or may not take account of the intelligence provided about the milieux concerned. But, as Walter Lippmann noted in 1922, a wide gulf divides "the world outside and the pictures in our heads," *i.e.* the total environment (or milieu) as it is and as it is apperceived. Professor and Mrs. Sprout have accordingly asked themselves how decisions in international politics are made and their analysis leads them to consider the working hypotheses of man-milieu relationship adopted by geographers and others who are students either of environment or of human behaviour. Thus, while they present their study as an enquiry within the field of political science, they bring into their discussion the relevant concepts, hypotheses and ideas of Anglo-American sociologists, political scientists, psychologists, historiographers and geographers. The contributions of British geographers to methodological discussion receive particular attention, notably those of Mackinder, Griffith Taylor, Wooldridge, Spate, Kirk, Clark, and Martin, whose paper deserves more consideration than it gets (p. 48). Certainly, one interest for geographers in this essay will be to discover how their colleagues and they themselves have survived the critical scrutiny of the Sprouts.

This essay, though set out in somewhat formal terms, is enlivened by apt illustration. The emphasis on the necessity of prediction in the social sciences (p. 87) and on the dichotomy between the environment as it is (or was) and as it is (or was) apperceived is valid and helpful. The authors conclude that political geographers contribute effectively to the study of international politics by their approach from the ground of environmental probabilism. Another approach is no less necessary, namely that based on the concept of cognitive behaviourism. This essay is welcome, *inter alia*, as an invitation to geographers to pause to reconsider the hypotheses which they are making in their work: such reconsideration is doubtless salutary as well as disturbing.

W. G. EAST

MÉDECINE MONTAGNE. By J. RIVOLIER. *Paris: Arthaud Masson*, 1956. 8½×6 *inches;* 201 *pages; diagrams*

Dr. Rivolier's work 'Médecine montagne' deals with the medical and physiological aspects of mountaineering in its widest sense; and is not only concerned with the problems of climbing at great altitude, as the photograph on the cover may suggest. The author's aim has been to present his material in a way that can be easily understood by readers without specialized knowledge; yet, at the same time, enough technical detail is given to serve the needs of leaders and organizers of mountaineering expeditions, as well as medical officers without previous experience in this field.

The book falls roughly into three sections. The first part deals with theoretical aspects—the physical environment in mountains, the physiology of muscular exercise and human adaptation to cold, and lack of oxygen. The second part is concerned with practical applications, giving detailed information on diet, protective clothing, oxygen equipment for high altitude expeditions, as well as practical rules about acclimatization. The latter part of the book deals with the pathology and treatment of medical and surgical conditions, such as mountain sickness, shock, frostbite, exposure and snowblindness. In the treatment of frostbite, the policy of rapid

rewarming of the affected parts agrees with British and American practice, but heroic measures, such as stellate ganglion block and intra-arterial injection of vasodilator drugs, which the author advocates, have not found favour outside France and are hardly suitable for field conditions. There is no doubt that many lives are lost in mountaineering, due to ignorance of elementary physiological principles. This is just as true of inexperienced climbers in Wales who get benighted and die of exposure through failure to take dry clothing and waterproofs in their rucksacks, as it is of Himalayan parties who make wrong decisions, with fatal consequences, under the influence of oxygen-lack due to insufficient acclimatization. Dr. Rivolier's book should do much to remedy this situation.

GRIFFITH PUGH

BIOGRAPHY AND TRAVEL

ESSAYEZ. The Memoirs of Lawrence, Second Marquess of Zetland, K.G., P.C., G.C.S.I., G.C.I.E. *London: John Murray*, 1956. $8\frac{3}{4} \times 5\frac{1}{2}$ *inches;* xii+297 *pages; illustrations.* 28*s*

In this autobiographical record, entitled with his family motto, Lord Zetland has attempted to outline his distinguished career of oriental travel and Indian administration. He has been handicapped by the fact that his early travels in the East, which began at the age of twenty-two, have already been adequately described in books published in the first decade of this century, while his experiences as Governor of Bengal and his views on the problems of Indian administration were dealt with in a trilogy of books which appeared more than thirty years ago. The present volume, therefore, is somewhat of the nature of a cold steam pudding, the flavour of which is not improved by the author's rather heavy style and his propensity for lengthy, unpunctuated sentences.

Lord Zetland was born and brought up in an easier and more leisured age and in circumstances which permitted him to indulge alternately in foreign travel, government service, stalking deer in Scotland, and racing at Newmarket. The most useful and interesting phase of his career was his five-year period of office as Governor of Bengal. He proved a successful Governor at a time when the growth of Indian aspirations for independence had given rise to a wave of terrorism in Bengal and the Punjab. Lord Ronaldshay (as he then was) took a sympathetic interest in Indian philosophy and cultural ideals and fulfilled his difficult task with tact and consideration. After his five years in Bengal Lord Ronaldshay was elected President of the Royal Geographical Society, a post which he held from 1922 to 1925, when the first Everest expeditions were being launched in cooperation with the Alpine Club. His book, however, has little to say about this period. His last spell of government service came in 1935, when, as Lord Zetland, he was appointed Secretary of State for India by Mr. Baldwin, and had to pilot the Government of India Act in its last stages through Parliament, although at heart he disapproved of many of its provisions.

J. MARSHALL CORNWALL

LAWRENCE OF ARABIA. By ERIK LÖNNROTH. *London: Vallentine Mitchell*, 1956. $9 \times 5\frac{1}{2}$ *inches;* 102 *pages; map.* 13*s* 6*d*

In 'Lawrence of Arabia,' a thin volume without illustrations except for a Turkish cartoon, a Swedish professor has attempted to "give as objective as possible a picture of Lawrence" and has succeeded in avoiding the excesses of both hero-worship and denigration. Lawrence's actual exploits in Arabia and subsequent career are only briefly described except that there is a full and interesting account of the part he played in the Franco-British negotiations regarding the future of the Middle East after the First World War. Much space is devoted to an analysis of his motives, and the strange vagaries of the latter part of his life are ascribed to the breaking of his spirit by his failure to bring about the creation of a "brown dominion" in the Middle East in the Paris negotiations and the shock caused to his nervous system by his plane

accident near Rome in 1919. The author discusses 'The seven pillars of wisdom' at some length and reaches the conclusion that as a biographical document it is a source of extraordinary value but that as a source for the history of the Arab revolt it must be used with caution. Personally I find that M. Lönnroth has considerably modified my antipathy to Lawrence. The book is a translation from the Swedish. The earlier chapters are rather heavy, due perhaps to too close an adherence to the original, but the latter part of the book makes excellent reading. W. R. HAY

MAN THE ROPES. By AUGUSTINE COURTAULD. *London: Hodder and Stoughton, 1957. 7½×5 inches; 188 pages; endpaper maps, photographs. 12s 6d*

August Courtauld's many friends will be pleased, and perhaps surprised, to find his pungent personality concentrated into less than 200 small pages of print. A doer rather than a talker, the author of 'Man the ropes' does something less than justice to an adventurous life, but the book is full of good stories, and recalls an interesting phase in the Society's history—the period of Gino Watkins' Greenland Expedition in 1930. August Courtauld's admiration for Gino Watkins is simply and movingly expressed, and there is a pleasing glimpse of Sir James Wordie, the present Master of St. John's College, Cambridge, attacking Greenland with a geological hammer, and clad in a "kilt and tam-o'-shanter." The author's own five-month ordeal snowed up on the ice cap is, of course, one of the great Polar stories: the Courtauld motto is "Tiens ā la verité" and those who know the family know also that the "holding" is as characteristic of them as the thing held. DOROTHY MIDDLETON

TRAVEL BOOKS

THE HEART OF THE HUNTER (*Muller*, 1957, 18*s*) is an account by Edison Marshall, a Middle West American, of his adventures in hunting in Canada, Alaska, Kenya, Indo-China, Assam, and Burma. It shows clearly how a courageous hunter quickly gains experience under a good guide. Animal trophies are limited by licence, and to get his trophies Mr. Marshall undergoes some hair-raising experiences. It is good to appreciate that he does not pursue his expensive hobby indiscriminately nor without some misgivings. The book gives considerable insight into the organization of a hunt and of the privations of the hunter, and emphasizes the patience and unwavering concentration required throughout a hunt. Mr. Marshall puts his experience to good account when he visits Assam for a second time to rid villages of the cunning old tigers which had preyed upon domestic animals for many years. There are excellent descriptions of animal life in Kenya and Indo-China, and this is throughout a stimulating book concisely written.

Six times round the world, three times before the war in a schooner and three times since in a brigantine, is ocean travel indeed. *Yankee's* PEOPLE AND PLACES by Irving and Electa Johnson (*Hale*, 1956, 21*s*) is about the sixth world journey which took place between November 1953 and May 1955. The *Yankee's* home port is Gloucester, Mass., and it is the little known places, mainly in tropical waters, which are visited—such as the Galapagos Islands, New Hebrides, Solomon Islands, New Guinea and West Indies; the risks of sailing in not-so-well-charted waters are not minimized. The crew of amateurs, all strangers to one another, soon shake down, and the lavish hospitality received by the crew from isolated families emphasizes the importance of the event of the *Yankee's* visit. The greater part of the book was written by Electa Johnson in cooperation with her husband, and extracts from crew-member Lydia Edes' diary are shown in the text in italics.

Mr. Stanton Hope's message in DIGGERS' PARADISE (*Hale*, 1956, 18*s*) is obscure. The story is certainly not of an Australian paradise. If the author had not made it clear to the contrary this book would read as that written by a disgruntled returned migrant. He dwells on the unpleasant things of Australia—the snakes, spiders, and sharks; the Australian way of life he describes would surely deter any conscientious

and hardworking migrant! After all it is not everyone who wants to drink or gamble. If there is a lack of culture it is up to those who lament its absence to create something. References to Mr. Hope's 1912 visit and other irrelevant material unfortunately does not make this a concise account of the contemporary Australian scene. Familiar ground is often trodden, but even when portraying an Australia not featured in tourist literature Mr. Hope has failed to make an outstanding contribution to the increasing number of books about this vast land. P. J. T. BARBARY

CARTOGRAPHY

ATLAS AÉRIEN. By PIERRE DEFFONTAINES and MARCEL JEAN-BRUNHES DELAMARRE. Tome I: Alpes, Vallée du Rhône, Provence, Corse. *Paris: Librairie Gallimard*, 1955. 11×8½ *inches;* 184 *pages and index*

This is an excellent picture-book of 209 oblique and vertical air photographs of south-eastern France and Corsica. The photographs are all of high quality and well reproduced; and the practice of printing obliques and verticals on opposite pages, so that they can be easily compared, is much to be commended. In air photography the oblique view is often useful and informative, but it is also a concession to those who have not learnt to read a vertical one—for it is the vertical view that is the outstanding achievement of flight. The views here provided include both level and mountainous country. The text explains the tectonic and geological features as well as those for which man is responsible, such as field patterns, terrace cultivation, walled and other towns, and castles. These pictures should be invaluable to teachers and students, supplementing (but not of course replacing) maps and text-books of geography. Plate 33 (Massif des Bauges in Savoy) should help the beginner to understand what a syncline is, for it shows the whole of a downfold or synclinal valley, whose dome has been eroded away in the orthodox text-book style. Five maps in relief indicate, by numbers and ingenious conventional signs, where the views were taken.

In France it is normal to assume that the average educated reader is familiar with the bare outlines of earth history, represented by the elementary terms of geology. Geography, and particularly human geography, has always been very much at home here; and some of the most beautiful topographical maps ever published (such as the incomplete 1 : 50,000 series) have been drawn by French draughtsmen. In North Africa and in Syria pioneer work has been done in archaeological air photography, and the recently published Atlas of Centuriation in Tunisia is an outstanding achievement based entirely upon air photography. It is, therefore, remarkable that in France itself practically nothing has been done by way of using air photography to discover and record archaeological sites. There must be many crop-sites that could be thus found, and it is to be hoped that the skill and enterprise already so successfully employed abroad may now be brought to bear on France itself. It is true that strip-cultivation is a severe handicap, but it is by no means universal, and even where it does occur crop-sites may be detected. O. G. S. CRAWFORD

CORRECTION

The Editor regrets that in the *Journal* for June 1957 (Vol. 123, Part 2, page 253) the 'British Columbia Atlas of Resources' was described as being "edited by J. D. Chapman and D. B. Lewis." The names of the editors of this atlas are J. D. Chapman and D. B. Turner.

THE SOCIETY'S NEWS

THE OFFICERS AND COUNCIL OF THE SOCIETY

Following the Annual General Meeting on 11 June 1957, General Sir James Marshall-Cornwall is to continue as President for a further year. Sir Raymond Priestley and Sir Miles Clifford become Vice-Presidents in place of Lord Nathan and Marshal of the Royal Air Force Sir John Slessor. Lord Nathan becomes a Trustee. Of the eight new members of Council, seven will serve for the first time, namely Major-General J. G. Bruce, Major-General L. F. de Vic Carey, Mr. R. C. Honeybone, Mr. C. M. Pollock, Dr. George Taylor, and the Earl of Verulam. Miss J. B. Mitchell served on the Council from 1949–52.

Major-General J. G. Bruce, formerly the Commandant of the Civil Defence Staff College, was a member of the 1922 and 1924 Everest Expeditions. Major-General L. F. de Vic Carey was Director of Military Survey and is now Director-General of Ordnance Survey in succession to Major-General J. C. T. Willis, who served several years on the Council. Mr. R. C. Honeybone is Reader in Geography, Institute of Education, University of London. Mr. C. M. Pollock is a geologist now in Government service, with extensive geological experience abroad. Dr. George Taylor is Director of the Royal Botanic Garden, Kew. The Earl of Verulam is Chairman of the Enfield Rolling Company; he has wide educational as well as industrial interests, and is a Governor of Bryanston School, Dorset and lectured to the Society in 1951. Mr. W. D. C. Wiggins is Deputy Director of Colonial Surveys.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

H. H. Lamb is on the staff of the Meteorological Office of the Air Ministry; his paper on "Weather variations in the Antarctic," written with Commander G. P. Britton and published in the *Journal* for September 1955, reached conclusions subsequently confirmed by the United States Operation Deepfreeze, and referred to in 'Antarctica and the International Geophysical Year,' the U.S. National Committee's official publication. *John Grover* is directing the Geological Survey in the British Solomon Islands where he has travelled widely during the last seven years. *C. J. Edmonds* served in western Persia and in 'Iraq as a consular and political officer from 1912 to 1923; he was then seconded for service under the Government of 'Iraq and from 1935 to 1945 held the post of Adviser to the Ministry of the Interior. *Professor Dudley Stamp*, who, as President of the International Geographical Union 1952–6, presided over the Rio de Janeiro Congress in August 1956, is Professor of Social Geography in the University of London, at the London School of Economics; *Professor J. A. Steers*, who led the British delegation at Rio, is Professor of Geography in the University of Cambridge. *Dr. Allan Black Cunningham*, a fighter pilot in the Second World War, and now lecturer in modern diplomatic history, University of London, has climbed in Europe, South Africa and South America. *R. J. Rice* is on the staff of the Department of Geography, Queen's College, Dundee. *Ian Carruthers* is a member of the research staff, Ministry of Housing and Local Government.

ITALIAN MAP OF K2

Professor Ardito Desio, who received the Patron's Medal this year, has presented to the Society a copy of the map of K2 based on the photogrammetric survey carried out under his direction by the successful Italian expedition: 'K2. Spedizione Scientifico-Alpinistica Italiana al Karakorum, 1953–55. Rilievo stereofotogrammetrico terrestre del 1954.' 1 : 12,500. (Firenze: Istituto Geografico Militare, 1957.)

This is a very effective map, finely drawn and well printed in four colours. The rock drawing is in black, the contours at 25 metre interval, shown on glaciers and snow slopes, are in blue, and scree slopes are also contoured. The relief is reinforced by oblique shading in a blue-grey tone. The route of the expedition to the summit and the high camps are in red.

Professor Desio has also supplied some unpublished notes on the survey. This was carried out by Capitano Francesco Lombardi, topographer of the expedition and technician of the Istituto Geografico Militare, with assistance from Professor Antonio Marussi, geophysicist. The survey was made with a Wild T 2 phototheodolite in sixteen days in August and September 1954. Twelve stations were occupied on the Godwin Austen glacier, from some kilometres below its confluence with the Savoia glacier up to "Windy Gap" (Sella dei Venti), and one on the upper Savoia glacier. The area surveyed photogrammetrically constitutes 85 per cent. of the map area: the remainder includes dead ground, filled in from photographic panoramas, and the northern face of the summit, mapped from a stereo pair of photographs from the film taken on the flight round K2.

Professor Desio also refers briefly to the cartographical history of K2 since the publication in 1892 of Conway's map on the scale of 1 : 126,720. The first detailed delineation was by F. Negrotto Cambiaso, the topographer of the Abruzzi expedition of 1909. A considerable part of his map was a photogrammetric survey, the first time, Professor Desio believes, that this method was used in high mountain survey. Owing to the mountain's isolated position, no special map was made until the Duke of Spoleto's expedition of 1929, though Mason, on his Shaksgam expedition of 1926, surveyed photogrammetrically the highest parts of K2 from a considerable distance and on a small scale. The Spoleto map of 1929 was compiled from photogrammetric data obtained by the Duke from the Concordia cirque, integrated with topographical sketches executed by Professor Desio, stereoscopic views and photographs. For the first time the northern face was included in a special map, having been photographed from the Shaksgam valley at a distance of approximately 13 miles. The northern face was also mapped by Shipton's expedition of 1938. G. R. CRONE

BURTON AND SPEKE CENTENARY

It was in June 1857 that there set out from Zanzibar to explore the lake regions of Central Africa an expedition led by Captain Richard Burton, with Captain John Hanning Speke as second in command. Centenary celebrations were held in Dar-es-Salaam in June last under the patronage of the Governor of Tanganyika, and the occasion was marked by the Society in an exchange of messages of goodwill with the Tanganyika Society, and in the loan for exhibition of Speke's sextant and his sketch book of African birds. Burton's expedition was sponsored by the Society; Sir Roderick Murchison, in his Presidential Address to the Annual Meeting of 1857, spoke of "our clever and adventurous travellers," adjectives which serve admirably to describe the respective characters of the two men who set forth from Africa's east coast just one hundred years ago to search for the sources of the Nile—for the fabled snow mountains reported by Krapf, Erhardt and Rebmann and the "great inland sea" which is the most persistent of travellers' tales in unexplored lands. Letters in the Society's archives underline the wide temperamental differences between the two men, and stimulate yet again the wonder that they should ever have liked or understood each other well enough to go travelling together. The story is, of course, well known: how Burton led the expedition to Lake Tanganyika which it was thought

might be the source of the Nile; how ill health and differences of outlook exacerbated the lack of sympathy between the two men; how Burton allowed Speke to go alone from Kazeh to the north to seek another great lake which Speke determined was the real source, and which he named Victoria; how Burton first accepted Speke's findings, but later turned against his companion, plunging more deeply into abuse and misrepresentation in the years following Speke's tragic death in a shooting accident; how Baker discovered Lake Albert, but mistook its size; and how eventually in 1890 Stanley mapped the lake regions of Central Africa, and identified the Ruwenzori range as the legendary "Mountains of the Moon."

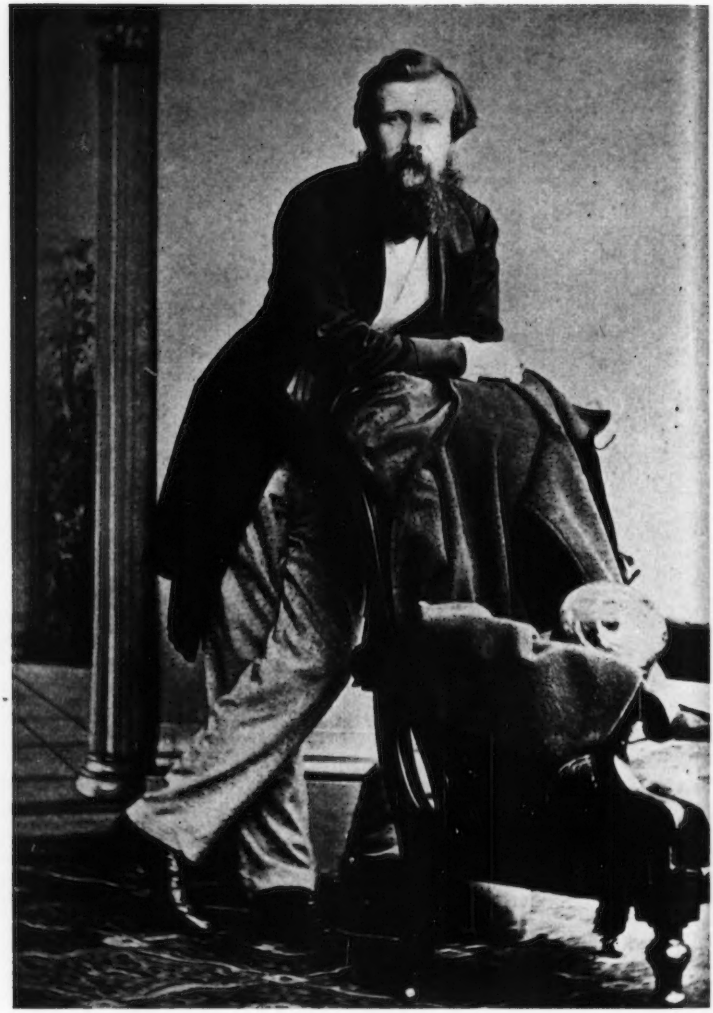
Burton was the *enfant terrible* of Victorian travellers: when the hue and cry after Livingstone was at its height, and every explorer or would-be explorer in the United Kingdom was clamouring to be allowed to go and look for the famous missionary, Burton could write to a friend that it would be "rather *infra dig.* to discover a mish." Vain and eccentric, idolized by his wife and abhorred by authority, his smouldering gaze can still fix the visitor to Leighton's fine and tragic portrait, and the impact of his harsh personality has survived the grave. It is not so with Speke: there was nothing *terrible* about him, rather was he what the French call *bon enfant*—honest, predictable, sensitive to sarcasm, anxious to be in the right. Sir Francis Galton would have liked to see the glade in Kensington Gardens where Speke's memorial stands arranged to commemorate all the great African travellers of the time, but, in view of the Nile sources controversy, it was difficult even to agree on an inscription for Speke alone; the obelisk was eventually lettered uninformatively "Speke" and "Victoria N'yanza and the Nile." How revealing is a comparison with the fantastic stone tent which houses Burton's remains at Mortlake!

Equally revealing are the glimpses we find in contemporary comment and in their own letters. "Burton," says Galton in his autobiography, "was a man of eccentric genius and tastes, orientalized in character and thoroughly Bohemian. Speke, on the other hand, was a thorough Briton, conventional, solid and resolute. Two such characters were naturally unsympathetic. . . . Burton had many great and endearing qualities, with others of which perhaps the most curious was his pleasure in dressing himself, so to speak, in wolf's clothing, in order to give an idea that he was worse than he really was." Their whole approach to life was different. Listen, for instance, to Burton living at Shepheard's in Cairo, disguised as a Haji, evidently considering a Nile journey: "Krapf just arrived from Zanzibar with discoveries about sources of White Nile, Killamanjaro and Mts. of Moon which remind me of de Lunatico—I have not seen him but don't intend to miss the spectacle, especially to pump what really has been done and what remains to be done. . . . There is one Capt. Cohen a friend of Parkyns, who is going up for Abyssinian sport. He will never reach the place he proposes, I humbly opine. He has all the newest guns instead of good rough and ready old ones and though a good fellow appears uncommon mild. . . . Plenty of small tourists on the start. No end of gents who keep journals and will doubtless commemorate their Nile boats and Dragomen in mortal prose. We've an American missionary woman at the hotel who proposes authorship: 'tis to be hoped she won't write as she conversationises . . . at dinner I catch her gimlet eye and see the ears well open and consequently oh Shaw! wonderful are the tales of Yemen which are conveyed to her 'sensorium.' " Speke, on his way to Africa in 1860, found a more conventional kind of enjoyment in hotel life, and writes from Madeira: "Here we are all right and as jolly as can be. Last night I was dancing away with the belles dames of this place until I nearly melted. There are some wondrous girls here, charming, sweet and goodnatured. Don't you envy me." By now Speke was travelling with Grant and happier than on the weary road back from the lakes when Burton who "never can be wrong" used to snub him "most unpleasantly."

Over much that Burton writes, particularly on his African travels, hangs a miasma of disagreeableness—he is critical, contemptuous and complaining. Clearly he enjoyed quarrelling: we find him deploring the fact that, in 1853, there were in Cairo

National Portrait Gallery

Sir, Richard Francis Burton (1821–1890)
By Lord Leighton



John Hanning Speke, discoverer of the source of the Nile, 1827–1864

"No rows, no 'popular feeling.' I'm sick of the place." Equally clearly, Speke was prone to being involved in quarrels; his difference with Burton, though it overshadowed everything else, was not his only one—there is the not altogether happy episode of Petherick, the British Consul at Khartoum who failed to make contact with Speke and Grant on their way north from the Victoria in 1863.

But it is, after all, achievement that matters, and despite incompatibility of temperament and divergence of opinion, despite fever, blindness and privation, Burton was the first white man to sail on Tanganyika and Speke the first to behold the Victoria N'yanza whence springs the Nile. The question of the sources is solved, and let us remember the seekers, not as the embittered opponents in an old quarrel but each in his own place in Frank Galton's kindly pages; Burton, the eccentric genius who was so much better a man than he made out; and Speke with his friend Augustus Grant, coming to say goodbye to the Society on their way to Africa in 1861. "They were fine manly fellows," reminisced Galton, "and I can see them now in my mind's eye, as they came to take a final leave, when I knocked two nails into the side of a cupboard as they stood side by side with their backs to it, to mark their respective heights and as a memento of them when away." Are the nails still there, perhaps, in some old and unregarded piece of office furniture? DOROTHY MIDDLETON

THE MOUNT EVEREST FOUNDATION

The Mount Everest Foundation Report and Accounts for the year 1956/7 have been published, and show that a total of £26,145 has been paid out. Twenty-six expeditions received grants of sums varying from £50 up to £1700, and nine special payments were made, including substantial assistance to the Society towards the compilation of the Everest map and of the map of the Central Andes of Peru (*Journal* for March 1957), and towards the purchase of surveying instruments. The Trans-Antarctic Expedition has received £5000. The Mount Everest Foundation was jointly constituted by the Society and the Alpine Club in 1954, for the support of mountain exploration and research.

At the Annual General Meeting the term of office of Sir John Hunt as Chairman and General Sir James Marshall-Cornwall as Vice-Chairman ends. The Society has nominated General Sir James Marshall-Cornwall as Chairman and the Alpine Club has nominated Mr. B. R. Goodfellow as Vice-Chairman. At the same time, Sir John Hunt, Sir James Wordie and Captain A. R. Glen, R.N.V.R., retire from the Committee of Management. The Alpine Club has nominated Dr. N. E. Odell and Mr. J. W. R. Kempe in the place of Sir John Hunt and the late Lieutenant-Colonel H. W. Tobin. The Society has nominated Sir Raymond Priestley and the Rt. Hon. the Lord Rennell of Rodd in place of Sir James Wordie and Captain A. R. Glen.

OXFORD UNIVERSITY EXPLORATION CLUB

Bulletin No. 8 (1957) of the Oxford University Exploration Club shows an interesting new trend in editorial policy. An attempt is being made to write accounts of the Club's expeditions in such a way as to provide information on aspects of expedition technique that are of general interest, and to list these so that they may be easily referred to by organizers of future ventures. The current *Bulletin* contains articles on the expeditions to Southern Morocco and North East Land (1955) and to Socotra and 'Iraqi Kurdistan (1956), and it also contains a particularly valuable paper on equipment for summer Arctic travel. Copies of the *Bulletin* (price 2*s* 3*d*) are available from the Editor, OUEC Bulletin, Soil Science Laboratories, Department of Agriculture, Oxford, and the five articles may be obtained separately at 9*d* each.

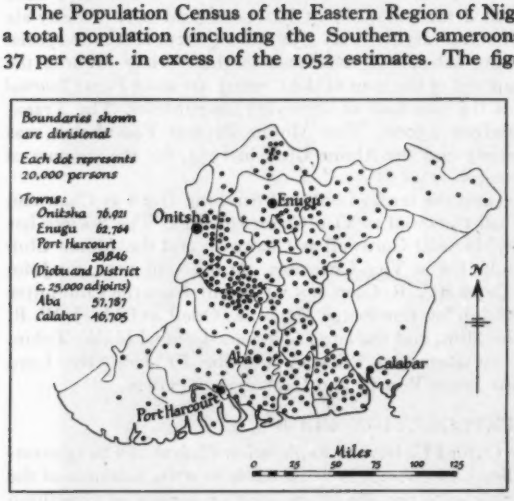
INTERNATIONAL CONFERENCE ON REGIONAL PLANNING

The Library has received from Professor L. Dudley Stamp a copy of the "Report of the First International Conference on Regional Planning and Development" held in London in September 1955. The Conference, organized by a committee mainly

composed of members of the Town Planning Institute, is described as "a demonstration of faith in the concept of regional planning for the development of world resources to the greater benefit of mankind." There were more than 360 members present from some forty territories of the world. The Report contains four main papers on the Tennessee Valley Authority's planning by E. A. Ackerman, the Volta river project by J. C. Liverman, the Indian community development project by T. S. Swaminathan, and planning in Italy by Carlos Doglio. Each paper is accompanied by comments and criticisms, and by summaries of the conclusions drawn from it by five discussion groups. One theme which recurs is the desirability of ensuring that the motive force in a regional scheme comes from the people themselves. Another recurring theme is the difficulty of establishing industries in under-developed countries to draw away the surplus agricultural population. Shorter papers deal with, among other subjects, planning problems in the Middle East and community projects in Mauritius, Jamaica and Nigeria. Geographers should find this Report of value in bringing to their attention social and economic aspects of regional planning which might otherwise be overlooked. The Report is published by the Provisional Committee for the International Centre for Regional Planning and Development which is now being established in Brussels.

A POPULATION DISTRIBUTION MAP OF THE EASTERN REGION OF NIGERIA

The Population Census of the Eastern Region of Nigeria[1] taken in 1953 recorded a total population (including the Southern Cameroons) of 7,971,187, which was 37 per cent. in excess of the 1952 estimates. The figure for the present Eastern Region alone is 7,217,829. The Census was the first taken from house to house and the figures were thought to be correct to within 3 per cent. The accompanying map shows population distribution worked out for the Eastern Region, on a village basis using topographical maps wherever possible. In the east, in Ogoja Province beyond meridian 8° E., suitable maps are not yet available, and the spread there, worked out from administrative officers' reports, must be considered less reliable than that in the west and south. A more detailed map[2] compiled from the same information but using one dot per thousand people can be seen in the Society's Map Room.



The larger population revealed at the Census increases interest in certain areas of dense population extending in a broad north-west–south-east band across the region from Onitsha to Calabar. Within this band is Orlu Division, registering at this Census a density of 873 persons per square mile; on population maps based on divisional boundaries this area stands out as the most congested. This new map, however,

[1] Population Census of the Eastern Region of Nigeria, 1953. Published by the Census Superintendent (Government Statistician), Lagos.

[2] Nigeria Eastern Region Population (1953 Census) 1:500,000, compiled by J. H. Jennings. Published by Federal Survey Department, Lagos, Nigeria, 1956.

suggests that the area to the south-east has even greater densities, in the northern part of Owerri Division and the southern part of Okigwi Division. An area of 1500 square miles delimited arbitrarily in the five divisions of Owerri, Okigwi, Orlu, Onitsha and Awka, not including the town of Onitsha, contains 1,500,000 people, giving an overall rural density of 1000 persons per square mile. This density is approached farther to the south-east in small areas around Ikot Ekpene and Uyo, between Aba and Calabar, and again in an area around Nsukka in the far north.

Even on this map the contrast between these closely settled areas and certain almost uninhabited parts adjacent to them can be seen. On population maps of the whole of Nigeria two concentrations, one in the East, and a second, somewhat smaller, in the West, stand out. While the explanation of this uneven spread must await further research, particularly historical, an appreciation of the facts is essential for all concerned with planning in Nigeria, whether in the agricultural, social or political fields.

J. H. JENNINGS

STRUCTURAL MOSAICS AND RELATED CONCEPTS: *A paper presented to the Geological Society of South Africa, 14 December 1956, and summarized below*

"Structural mosaics and related concepts" involves a new approach to structural geology, from a global background. It constitutes an attempt to work from the general to the particular, that is from the globe itself to a global structural pattern which forms a framework upon which to hang structural details. To work from an overall plan to a filling in of such details as are necessary, is the natural procedure in any construction. Yet structural geology as a branch of the earth science has been built up from an abundance of dips and strikes, folds and faults, without any overall plan, and has not progressed much farther. Structural geology ends where geologists begin to get out of their depth in matters physical or cosmological, and it does not go nearly far enough to meet its related sciences. Structural geology has therefore remained an ancillary branch, instead of achieving its rightful place as the most fundamental of all branches, in that it concerns the fragmentation of the globe itself. To this nearly everything geological can be tied, not merely with incidental links, but with a cause and effect relationship.

There are two chief reasons why the global apporach has been neglected. Firstly, a globe is not a handy thing, and not a normal part of a geologist's equipment, hence he does not normally think in global terms. Secondly, no one has ever answered the question: in measuring global physiographic features, what are we measuring geologically? The essay involves one major assumption, at the offset with a strong foundation in geological fact, but amply justified as the paper progresses. The assumption is that land forms today have an intimate relationship with a fundamental basement structure. Thus if we measure, say, between two margins of a continent represented for instance by a Palaeozoic folded belt and a line of Tertiary volcanics—on the face of it a geologically meaningless procedure—the answer is that the Palaeozoic folded rocks were contained in a pre-Cambrian trough, and the Tertiary volcanics owe their existence to a fissure involving the pre-Cambrian basement (as well as younger rocks). We are in effect measuring hidden pre-Cambrian features, which adds to our information on the primordial pattern, which has controlled geological events ever since. We can for the moment ignore geological age and date all lineaments to a pre-Cambrian origin.

The measuring of earth features is done on a globe with a pair of dividers, referred to the equator or to a meridian, and the measurement is thus in angles of arc subtended at the centre. The measurements of continents, oceans, shields, mountain ranges, island arcs, and such-like features reveals a great preponderance of angles which divide evenly into a quadrant or a circle, and this mathematical "coincidence" relates these measurements to the fragmentation of the globe. It emerges that lineaments of world importance are sectors of great circle structures which combine to bound rigid blocks of the crust which are normally in the form of polygons which

approximate an ellipse. It is in the junctions or hinge zones between the inert plates that geological processes are most active from every point of view. These linear zones (or arcuate in the broader view) are the lines of igneous activity, of rift valleys, of mineralization, of zones of weakness that have controlled drainage since earliest times, and in extreme cases of geosynclines and subsequent mountain-building.

This background allows of the building up of structural mosaics on various scales, the more coarsely featured mosaics being the youngest and the finest fragmentary ones being Archaean in age. In the geometric analysis of world features it becomes evident that the shields, the exposed remnants of the primordial earth, show a marked preference for 36°, 22½°, 18°, 15°, 10°, 7½° etc.; continents for 72°, 45°, 36°; seismically bounded units for 120°, 90° and 60° and oceans for 120°, 90°, 60° (not counting the Pacific whose origin may be different). The oldest "mountain ranges" or the folded belts of hinge zones bound the smallest units. The youngest or Alpine type of mountains bound the units of greatest dimensions measured in the semi-circumference of the globe. There is some evidence of a progression between the two, and this is taken as evidence of a progressive thickening of the earth's crust, an idea entirely compatible with the conception of a cooling sphere.

The final outcome is a practical one because it allows of some prognostication. We make use of the principle that "Nature works true to scale," one of the safest generalizations that was ever devised. It has been used in most other sciences but not nearly enough in geology, except perhaps in detailed studies of petrology and sedimentation. The treatise does not purport to explain the fragmentation of a cooling sphere. The mathematical problem presented falls into the realms of the physicist. The treatise therefore is not a theory—it is simply a broadening of the empirical background. It is a re-orientation of accepted facts, providing a new framework on which to tie geological details. It is hoped that it provides a broader common meeting ground between geology and physics than has existed hitherto. B. B. BROCK

ABRAHAM ORTELIUS

A short article on Abraham Ortelius by Albert de Burbure was published in *Lloyd Anversois* for 30 March 1957. This gives an interesting biographical sketch of Ortelius, emphasizing his travels and contacts with other scholars. The writer begins by stating that Ortelius, travelling through England and Ireland in 1557, produced the first map of Great Britain which is worthy of serious attention, but he does not elaborate this statement.

M. de Burbure records that Ortelius, born in Antwerp in 1527, was apprenticed as a map engraver, and in 1547 was admitted to the Guild of Saint Luke as an "afsetter van carten" (illuminator, or painter, of maps). While carrying on his father's antiquarian business, Ortelius also established a cartographical office. He made frequent journeys abroad with scientific as well as business objectives. He visited Oxford in 1551, and in 1557 made the journey in Britain mentioned above. From the Welsh antiquarian, Humphrey Lhuyd, or Lloyd, he later obtained material which he embodied in the map of England and Wales published in the 1573 edition of the 'Theatrum.' He attended frequently the Frankfurt Fairs, where he met Arnold Mylius who put him in touch with Gerhard Mercator, and on several occasions he travelled in Italy on behalf of the Antwerp shipowner, Gilles Hooftman. In 1560, in company with Mercator and others, he visited Trier, the Lorraine towns and Poitiers on an archaeological tour.

It is from this period that some important cartographical works by Ortelius date. At first he merely followed tradition in decorating his maps with engravings of Roman inscriptions, medals and ruins. There are no historical maps in the first edition of his 'Theatrum orbis terrarum,' 1570 (the first modern atlas), but among the new maps added to the first Plantin edition (1579), there are three historical maps—the journey of St. Paul, the Roman Empire and Greece. These three maps were the first of the "Parergon," or supplement, which, constantly enlarged, contained

about thirty maps at the beginning of the seventeenth century. Ortelius also added to his 'Theatrum' lists of geographical names. Thus was born the "Synonymia locorum geographicorum"; published separately in 1578, it became the "Thesaurus geographicus" in 1587. He provided also from 1570 a "Nomenclator Ptolemaicus," an index of names appearing on Ptolemy's maps. Besides his many business trips, Ortelius made journeys with scientific aims. The 'Itinerarium nonullas Galliae Belgicae partes' (1584) is the account of an archaeological excursion in Belgium with his friend Jean Vivien of Valenciennes.

In 1597, he prepared the publication of a fundamental source for the geography of the Roman Empire, the celebrated Peutinger Itinerary, at the request of Mark Welser, burgomaster and financier of Augsburg. On Ortelius' death, the work was completed by his friend Moretus of Antwerp. Ortelius' contemporaries called him the "new Ptolemy," and his chief merit was to have adapted the works of Ptolemy to the requirements of his age. His fame spread abroad, particularly in England, and the writer concludes by referring to the recent sale by auction of the Ortelius correspondence preserved in the Dutch Reformed Church, Blackfriars.

G. R. CRONE

SOVIET SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIYA) OF THE ACADEMY OF SCIENCES OF THE U.S.S.R., GEOGRAPHICAL SERIES, 1957, No. 1 (January–February). Cartography at the 18th International Geographical Congress, by K. A. Salishchev. New data on the sea bed and deposits of the Eastern Antarctic ocean, by A. V. Zhibago and A. P. Lisitsin. The pattern of season rotation in the northern hemisphere, by B. L. Dzerdzeyevskiy. Transportation in the wide expanses of Central Asia, by L. Y. Ziman. History of Soviet economic regionalization, by P. M. Alampiyev. Possible changes in the reserves of water in artificial and natural reservoirs in the flat parts of northern Kazakhstan, by I. T. Kuznetsov. The economic development of Kuybyshev oblast', by E. F. Fedorova. P. A. Kropotkin, the pioneer of research on the ice ages, by A. A. Velichko. A geographical symposium of Uganda, by D. B. Kravchenko.

BULLETIN (IZVESTIYA) ALL-UNION GEOGRAPHICAL SOCIETY, Vol. 89 (1957). No. 1 (January–February). Geographical theory at the 18th International Geographical Congress, by S. B. Kalesnik. The geographical distribution of monsoons, by S. P. Khromov. Hydrographic expedition to the Northern Arctic Ocean in the ships *Sudakh* and *Vaygach* (1910–15), by N. I. Evgenov. Some peculiarities of the valley system of the Soviet Carpathians, by P. N. Tsys'. Arabic navigation in the Middle Ages, by T. A. Shumovskiy. Studies of the physicogeographical complex of the Karelian isthmus, by K. M. Petrov. Anthropozoic times, by A. M. Zhirmunskiy. Karst waters of western Georgia, by L. A. Vladimirov. The centenary of the Vienna Geographical Society, by O. A. Konstantinov.

MEETING OF THE COMMISSION ON THE HUMID TROPICS

The first meeting of the Humid Tropics Commission of the International Geographical Union was held in the Royal Geographical Society on 11 and 12 June 1957. In attendance were Chairman—Dr. George R. T. Kimble, Department of Geography, Indiana University, U.S.A.; Secretary—Professor Theo L. Hills, McGill University, Montreal; Professor B. J. Garnier, University College, Ibadan, Nigeria; Professor Ferdinand J. Ormeling, Groningen, Holland; Professor Leo Peeters, Berchem-Anvers, Belgium; Professor L. Dudley Stamp, London School of Economics. The Humid Tropics Commission is one of two official commissions appointed by the I.G.U. at the General Assembly held in Rio de Janeiro in August 1956. The Commission will serve as an agency for the stimulation of research in the humid tropics and will act also as a central clearing house of information.

The Commission's first task will be the definition and mapping of the humid tropics. This project will be under the direction of Commission Member Professor B. J. Garnier. The humid tropics will be defined on a moisture basis, which calls for

data concerning the amount of water vapour present in the atmosphere, measured in absolute terms, and also as a ratio between potential evapo-transpiration and available moisture. Data concerning the duration of the humid period will also be required. Other projects to be undertaken during the next three years include the preparation of select, annotated bibliographies for the regions within the humid tropics and the preparation of a gazetteer of public and private agencies with interests in humid tropical research. Geographers interested in collaborating with the Commission in the mapping project are asked to write to Professor B. J. Garnier, who is responsible for its organization.

NOTES

The ROYAL UNIVERSITY OF LUND has recently published in English two more Lund Studies in Geography, in *Series B, Human Geography*: No. 17 "Bus services in Sweden" and No. 18 "The function and growth of bus traffic within the urban sphere of influence." Both are by Sven Godlund, and are English translations of the chief parts of a Swedish doctorate thesis discussed by F. H. W. Green on pp. 534–5 of the *Journal* for December 1954. They maintain the high standard of the Series in which they appear, and their interest in the field of human geography is much wider than their titles might indicate.

* * *

The Library has received from Professor L. G. Scheidl, the Director of the Geographisches Institut of the Hochschule für Welthandel, Wien, the first of a new series of geographical monographs, WIENER GEOGRAPHISCHE SCHRIFTEN. This is "Die Seehäfen des österreichischen Aussenhandels" by Dr. J. Kuligowski. All persons and institutions interested in exchange of publications should write to the Institut, Wien 19, Franz-Klein-Gasse, 1, Austria.

* * *

Copies of the SCIENTIFIC FILM REVIEW (Nos. 1 and 2 of vol. 3, February and April 1957) have been received. The *Review* is the journal of the Scientific Film Association, 164, Shaftesbury Avenue, W.C.2, which exists to "study, discuss, publicize and advocate the use of scientific and industrial films"; the *Review* contains useful lists of films on transport, medical subjects and Polar research.

* * *

The CORNHILL MAGAZINE for Spring 1957 contains an interesting article on John Hornby, a well-known figure of Canada's Northwest Territories in the years between the wars. The article, by George Whalley, deals at length with the adventure in the course of which Hornby met his death; and by which he has become known outside his own world as a result of the diary left behind by his young cousin Edgar Christian and published as 'Unflinching' by John Murray in 1937. It has long been the policy of the *Cornhill* to revive or elaborate stories of explorers; among recent such articles have been one on the Victorian traveller Isabella Bird Bishop (Winter 1952), one on the Lander brothers (Autumn 1953), and one on Richard Burton (Winter 1953).

* * *

The LUSO-BRAZILIAN COUNCIL announces conditions for the CAMOENS AWARDS for 1957. Three prizes to the value of £25, £15 and £10 are to be awarded in December for essays on some aspects of the history, literature, geography or economy of

Portugal and/or the overseas provinces of Portugal. Essays, which must reach 2, Belgrave Square, London, S.W.1, by December 1, must be typewritten and signed by a pseudonym or motto, with the writer's real name and assumed name enclosed in a sealed envelope; they should be from 5000 to 10,000 words in length, and the competition is open to anyone of British nationality. Questions of the eligibility of a proposed subject may be addressed to the Education Director at the above address.

* * *

We have received in the Library of the Society an issue of the BULLETIN of the UZBEK BRANCH OF THE GEOGRAPHICAL SOCIETY OF THE U.S.S.R. (vol. I (1955), or vol. 22 of the whole series). As might be expected, the contributors to the Bulletin are much concerned with problems of climate and irrigation; L. A. Molchanov, for instance, writes on possible changes in the climatic and hydrological conditions of Central Asia owing to the development of irrigation in its southern zone, while L. I. Shalatova and V. L. Shul'ts discuss respectively the influence of absolute altitude on the melting of snowfields and the evaporation and condensation on snowfield surfaces. Z. V. Dyhordzhio discusses the origin of Central Asian rivers, mainly with reference to the views advanced by A. I. Voyeykov. S. M. Momot writes on the forests of Uzbekistan and V. V. Akulov on the Karakalpak steppe, central Ferghana. The problem of coordinating Uzbek geographical terminology with that in use in Russia is also touched upon, in a note by Kh. K. Khasanov. A summary in English of all the articles in this very interesting *Bulletin* is available in the Library.

OBITUARY

THE AGA KHAN

1877–1957

His Royal Highness the Right Hon. the Aga Sultan Sir Mahomed Shah, G.C.S.I., G.C.I.E., G.C.V.O., G.C.M.G., died in Geneva on 11 July 1957, and an obituary appeared next day in *The Times* under the heading "A citizen of the world." The Aga Khan had been a Fellow of the Society since 1911 and was a generous contributor to the Building Fund. This financed the move of the Society from Savile Row to the present site, Lowther Lodge; a move largely due to Earl Curzon of Kedleston and carried out during his presidency.

WILLIAM ADLINGTON CADBURY

1867–1957

Mr. W. A. Cadbury, whose death at the age of ninety was announced on July 10, was Lord Mayor of Birmingham from 1919 to 1921 and former chairman of Cadbury Brothers. In the course of his long career he had travelled extensively in Africa and the West Indies, studying economic conditions at first hand. To the Royal Geographical Society, of which he had been a Fellow since 1918, he was a constant benefactor, his gifts including a handsome contribution to the Building Fund at the Centenary in 1930. Particularly interested in the history of cartography, and himself a collector of early atlases and maps, he also gave donations on several occasions to enable the Society to purchase rare items. He contributed in this way to the purchase of the great Hondius map of 1608 and of several volumes of maps for the Society's collections. These included the Wyld copy of the so-called Lafreri Atlas, and the

miscellaneous volume of maps formerly the property of William Burton, the sixteenth-century topographer. To provide students of historical cartography with reproductions of rare maps at a reasonable cost, he made possible the initiation of the Society's series of reproductions of early manuscript maps, and gave a further donation to the Hereford Map reproduction. Not only the Society but students of cartography throughout the world owe him a debt of gratitude for his thoughtful generosity and enthusiastic support.

G. R. CRONE

BRIGADIER DAVID HENRY COLE, C.B.E.

1887–1957

Brigadier Cole, who died in London on 4 May 1957, was a specialist in the somewhat neglected subject of military geography, and his book 'Imperial military geography,' which ran into a number of editions, is a standard Army text-book. In 1933 the University of Dublin bestowed a Litt.D. on Brigadier Cole for a thesis on the geography of Imperial defence, and it may be wondered whether a serving officer has ever before gained a doctorate by the submission of such a thesis. Brigadier Cole served in both World Wars, in the First with the R.A.S.C. and in the Second with the R.A.E.C.; from 1942–6 he was Deputy Director, Army Education. He was joint author with Major E. C. Priestley of 'An outline of British military history 1660–1936.'

MALCOLM LETTS, F.S.A.

Malcolm Letts, who died suddenly at Innsbruck on June 27 while on holiday, was a distinguished antiquary, an authority on medieval travellers, and a past President of the Hakluyt Society. Born in 1882, he was educated privately and abroad, and was admitted a solicitor in 1905. His linguistic abilities and extensive travels in Europe equipped him as a writer of travel books such as his 'Wayfarer' volumes on the Rhine and Central Germany, but his reputation was made by his critical editions of several medieval travel texts. His wide reading in the literature of the period is apparent in their annotations and scholarly introductions. Very fittingly with his tastes and accomplishments, he was for six years President of the Hakluyt Society (1949–55), at an important stage in the Society's history, and for thirteen years a Trustee. His shrewd judgement and loyal support were of great value to the Society. During his term of office as President the project for a critical edition of the Journals of Captain James Cook, R.N., was successfully launched, and other important decisions on policy were taken. He himself contributed several volumes to the Society's publications, beginning with 'Francis Mortoft, his book,' 1926, and concluding with 'The travels of Rozmital, 1465–67,' which appeared shortly before his death. His most important work for the Hakluyt Society was his 'Mandeville's travels: texts and translations,' published in 1953. Letts had already examined the Mandeville problem in 'Sir John Mandeville, the man and the book,' 1949, in which he argued that the traveller was the English knight Sir John Mandeville, the compiler being Jean d'Outremeuse. His Hakluyt Society edition contains the oldest text extant, which is in French, dated 1371, and previously unpublished, and two English texts. If he did not solve the Mandeville problem to everyone's satisfaction, he provided annotated texts, and presented his point of view forcefully. Letts also edited the narratives of Pero Tafur, Hans Staden and others.

Letts was always ready to put his wide knowledge at the disposal of others, and he will be remembered by many for his kindly and courteous disposition. He was an officer of the Order of Leopold II, and a corresponding member of the Académie Royale de Belgique. He became a Fellow of the R.G.S. in 1927.

G. R. CRONE

MAJOR-GENERAL SIR COURTENAY CLARKE MANIFOLD, K.C.B., C.M.G

1864–1957

Major-General Sir Courtenay Manifold, late of the Indian Medical Service, whose death at the age of ninety-three was reported in *The Times* of June 8, had been a Fellow of the Society since 1903. He was, however, well known as an explorer before that date, and had joined in the travels of Major H. R. Davies and Captain C. H. Ryder on the Burma–Yunnan frontier in 1899/1900. Major Davies (who received the Murchison Grant in 1906) and Captain Ryder (Gold Medallist in 1905) made frequent expeditions in the Burma–China frontier regions and along the upper Yangtze in the 1890's, surveying the ground with a view to opening up communications between India and China. Colonel Manifold, as he then was, accompanied them during the 1899–1900 season which is described, together with earlier and later work over the same terrain, in Davies' book 'Yün-nan—The link between India and Yangtze' (1909). Colonel Manifold was greatly interested in the geography of communications, and in November 1903 he read a paper to the Society about his travels on the upper Yangtze and in Sechuan, which were a continuation of the work done by Davies and Ryder. In April 1905 he addressed the Society again on "The problem of the upper Yangtze provinces and their communications" (*Geogr. J.* **23** (1904), pp. 281–313; *Geogr. J.* **25** (1905), pp. 589–620). General Manifold saw active service in many spheres, before and during the First World War, and in 1940 he became deputy commissioner for Cyprus for the British Red Cross.

CORRESPONDENCE

A SEVENTEENTH CENTURY TRAVELLER IN WEST AFRICA

Some time ago I was searching for historical data, on a subject far removed from geography, in the *English Historical Review* for January, 1924, and to my surprise came across a letter written by an Englishman—a servant of the Royal Africa Company—from James Island in the Gambia territory, in 1690. It gave details, too long to be quoted here, about an expedition this traveller had just concluded into southern Morocco, the whole of Senegal, and some six to seven hundred miles up the Niger during the reigns of James II and William III, in the course of 1688 and 1689. Here was a long forgotten record in the Public Record Office, found in the archives of the Royal Africa Company, *well over a hundred years before* Mungo Park had left England on his first attempt to pierce the veil of the land of Prester John from the western side of Africa.

We know little about Cornelius Hodges, but by his rudimentary style of writing we should not be far wrong if we inferred he had been actively engaged over many years in the buying and selling of slaves. Probably he had been a slaver captain—in his day vessels of 150 to 250 tons made ideal ships for this purpose; their comparatively shallow draft allowed them to ascend the African rivers and to warp into creeks where the forest came down to the water's edge, and there to pick up slaves. The passage across to the West Indies too was generally a smooth one in those equatorial latitudes and gales and storms would not often be encountered, so small craft would be most handy.

Hodges' main idea (so he relates) was to ascertain what new areas were available for the securing of slaves; the principal object of the company formed in London was the cornering of the slave market for their wealthy shareholders, many of whom were in Parliament and thought this was a most advantageous means of profit—*tempora mutantur et nos mutate illis*. As a secondary affair, Hodges was to see what possibility

existed of obtaining gold-mining rights from the native chiefs far in the interior, the French having already made extensive strides in this connection.

Hodges left James Island on 11 March 1688 and penetrated far into Kantor, a name used by early map makers to fill up blanks on the charts and portolans. It lay south of the Gambia and loosely defined much of the present Senegal and Ghana. Long before Swift's time the art of inserting savage faces instead of places, and o'er uninhabited downs placing elephants instead of towns was well known, and Kantor (I rather surmise) filled up much the same gap in the sixteenth and seventeenth centuries in these lands. In a period of twenty-one days Hodges had covered 230 miles, but then he had to reduce the size of his party and sent over two-thirds back to James Island, struggling on with two canoes and five hands, himself the only white man. After a series of adventures to which he nearly succumbed, and after being more than once in a state of near-starvation, he returned to James Island in the March of 1689. He seems to have feared the displeasure of his employers as he was not very successful in securing either slaves or gold; we hear little more of him, and do not know if he was rewarded for his exertions.

The narrative mentions quantities of dried fruits and native herbs, many of the areas the party passed through being well wooded, though here and there well pastured land was observed. Native husbandry was poor, no dung was placed on the agricultural areas, and fresh ground was broken for every crop. Reading the account I cannot help thinking this honest servant was trying to describe to his far-off principals, what the interior of Africa actually looked like. Perhaps, sir, your Council might even now after some 268 years be prepared to make some belated acknowledgement of Cornelius Hodges in the Lecture Hall? He might lack the scholarly erudition of Mungo Park, but his travels in those long distant times should not go unrewarded—*coelum non animam mutant qui trans mare current*.

I feel I should make some measure of thanks to the librarian of the library of the Honourable Commissioners of Customs and Excise, Mr. Rupert Jarvis, F.R.HIST.SOC., for allowing me to see the book in question; the original article was by Miss Thora G. Stone, F.S.A.

GEORGE PERCIVAL-KAYE

23, *Pollards Hill North*,
*Norbury, S.W.*16

5 *April* 1957

THE FABER ATLAS

The March 1957 edition of your Journal contains a very pertinent review of the Faber Atlas. I think it would be of interest to add something more about the origin of the atlas. At this moment I have on my desk four atlases all excellently produced by Verlag Ed. Hölzel in Vienna; The Österreichischer Mittelschul Atlas (Kozenn-Atlas), Lautensach's Atlas zur Erdkunde, the Nouvel Atlas Général (Bordas), and the Faber. It was the first of these which would seem to have been in fact the original. In the introduction to the 75th edition of the Österreichischer Atlas its origin is traced back to a Slovak geographer, Blasius Kozenn, who started this successful line of atlases, which were first published in 1863.

May I also mention that this is not the only example of different national editions of the same atlas to appear recently, *i.e.* the famous Bayer and De Agostini product originally made for the Container Corporation of America and then edited in German as the Goldmanns Atlas; then Esselte's Swedish Tidens Atlas successfully reduced in size as Penguin edition etc.

This is, of course, a very sound procedure for the proper exploitation of the serious investment required in the production of a good atlas.

J. J. KLAWE,
Lecturer in Cartography

Department of Geography,
Edinburgh

1 *May* 1957

MEETINGS: SESSION 1956–7

Meeting of 15 April 1957. Mr. Leonard Brooks in the Chair

Film: "Airport" and "Song of the Clouds." Shell Films with commentary by Sir Arthur Elton and John Armstrong

Meeting of 24 April 1957. Major-General R. Ll. Brown in the Chair

Paper: Tellurometer system of distance measurement. By T. L. Wadley

Meeting of 29 April 1957. The President in the Chair

Elections to Fellowship: Clifford W. Atkin; C. B. H. Barford; John Bond; Reverend Harold Carter; Douglas E. Grant; Herbert Grimson; John H. Kempster; David A. Montgomery; Parviz J. Patel; Brian Smith; John F. Smith; Brigadier George Bingham Still; J. C. C. Taylor; Julian Taylor

Elections to Associate Membership: David A. C. Clark; John C. Golding; W. G. S. Hodern; Kostas Panayiotou

Paper: South American prospect. By Professor J. A. Steers and Professor L. Dudley Stamp

Meeting of 13 May 1957. The President in the Chair

Paper: Cambridge Expedition to North Borneo. By D. P. J. Wood and B. J. Moser

Meeting of 27 May 1957. The President in the Chair

Elections to Fellowship: James Henry Abel; Suraj P. Agrawal; Richard W. Andrews; Ewart Victor Asplin; Neville Bellerby; Douglas Botting; Charles S. Brindley; Henry William Bunje; John H. M. Butler; George F. Campbell; Wilkie Gordon Collins; John Kyle Cook; Christopher M. Dixon; F. W. Edwards; Dr. Stanley Evans; The Hon. Mrs. E. Gibson; Derek Charles Glover; Rev. Dr. John P. Grant; Mrs. Marvin Hensley; Eric William Hunt; Cecil Henry King; J. W. R. Kempe; Harold B. L. Levy; R. A. J. Lippett, M.B.E.; Lieutenant-Commander G. Howlett-Martin; J. F. Dermot Murphy; Lieutenant David William Newton; Chris. R. O. Obianika; Thomas A. E. Phillips; Coenraad Potgieter; K. E. C. Powell; Sir George W. Rendel; O. R. Rudston de Baer; David H. Smith; Hugh Tennant; Frank Thompson; J. C. de F. Thompson; J. R. Topping, B.SC.; Miss S. K. E. Waddell; Miss K. Ward; J. Conrad Waterlow; Wilfred Whalley; J. T. White

Elections to Associate Membership: Michael John Barnes; Miss Irene J. M. Derbyshire; Miss Patricia Gregory; Midshipman Nicholas Newman

Paper: Pioneer Settlement in South Asia. By B. H. Farmer

Meeting of 3 June 1957. Lord Rennell in the Chair

Paper: Oxford Expedition to Socotra. By D. L. Botting

ANNUAL GENERAL MEETING, 11 June 1957. The PRESIDENT, General Sir JAMES MARSHALL-CORNWALL, in the Chair

The HON. SECRETARY, Dr. Edward Hindle, read the Minutes of the Annual General Meeting held on 18 June 1956, and these were confirmed and signed by the President.

The PRESIDENT then delivered his Presidential Address which is printed at pages 283–286.

The PRESIDENT: We now proceed to the presentation of the Medals and Awards. Her Majesty The Queen has approved the award of the *Patron's Medal* to Professor Ardito Desio, Director of the Geological Institute of the University of Milan, who organized and led the successful Italian expedition of 1954 to K2 (Kappa Due), the second highest summit in the world. Under his direction the expedition also carried out important scientific work, including a photogrammetric survey of K2 and of the upper Baltoro glacier. Professor Desio first went to the Karakoram Himalaya in 1929,

when he accompanied the Duke of Spoleto's important expedition as geographer and geologist. He has also carried out research in other areas, particularly in North Africa. But it is especially to mark our high appreciation of his exploration and surveys in the Himalaya, as well as his distinguished leadership of the expedition to K2, that he receives the Patron's Medal today. I would add that Professor Desio has presented the Society with the first proof copy of his most beautiful map of K2 on the scale of 1/12,500—a really perfect piece of cartographic work. *Signor Dottore, sono lieto di darle il benvenuto dalla nostra Società, e di accordarle la Medaglia d'Oro di nostra Patrona Reale.*

Professor ARDITO DESIO: Mr. President,—I sincerely thank the Royal Geographical Society for the unexpected honour which it has conferred on me today by the presentation of the coveted Patron's Medal. It is an especial honour to have as predecessors the famous explorers for whom I have so much admiration. I would have considered myself very immodest had I expected to be one day compared to them. The names of the famous British explorers of Africa, the Himalaya and elsewhere have long been impressed on my mind; indeed, their wonderful expeditions exerted a great influence on my career. All honour be to them and to the Royal Geographical Society under whose auspices so many glorious enterprises have been carried out. Thank you.

The PRESIDENT: The *Founder's Medal*, with the approval of Her Majesty The Queen, has been awarded this year to Sir George Binney, who already holds the Gold Medal of the Geographical Society of Paris, the oldest Geographical Society in the world. It is in some respects an unusual award, for services rendered a good many years ago. In making it, your Council had in mind the obvious need to rectify an important omission by our predecessors. Sir George Binney's award is made for his contributions to Arctic exploration, with special reference to the pioneer use of air survey technique in the Arctic and to the development of the university exploring expedition. Sir George Binney was the organizer of the Oxford Expedition to Spitsbergen and North East Land in 1921, and he was leader of the Merton College, Oxford, Expedition to the same area in 1923. He also led a very important expedition to North East Land in 1924, and during this expedition crossed the North East Land ice cap and investigated important glaciological and other problems first raised by Baron Nordenskiöld. It was during this last expedition that a seaplane was used for the first time in such a far northern latitude to provide air photographs for mapping purposes, and the results of these air operations form an important pioneer contribution to the technique of air survey which is now such an essential element in the exploration and development of remote regions.

An account of Sir George Binney's expeditions, from which all subsequent Oxford expeditions stemmed, is contained in his book 'With seaplane and sledge in the Arctic.' The appendices to that book, covering every aspect of the planning and preparation of expeditions of this kind, have formed a basis for the organization of all subsequent university expeditions which are today such a feature of British exploration. It gives me much pleasure now to make the award of the Founder's Medal to our Vice-President, Sir George Binney.

Sir GEORGE BINNEY: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—It was an unexpected honour to me when I returned two months ago from South America to find on my desk a letter from the Society informing me of the award of the Founder's Medal. It was something more out of the blue than I could ever have thought of, but I assure you that what really gives me the most profound satisfaction is the fact that it has been associated with the Oxford University expeditions which were started shortly after the 1914–18 war. The first Oxford University expedition to the Arctic was in 1921 and there were two following expeditions. What particularly pleased me in the citation was the reference to our early flying venture because in 1924 there was no such things as Moths to fly about in fairly reasonable safety. We did, in fact, go down to the aerodrome at Hamble and ask them for a

fuselage; they had then old war fuselages. They having given us a fuselage, we said we must find an engine. So we went to Mr. Siddeley and he gave us an engine. In fact, the only thing we had to acquire for our expedition was a boat. That was the first use of aircraft in Polar exploration. I am delighted to see two members of our air crew here today, Sir Frederick Tymms, who was lent to us by the Ministry of Civil Aviation in 1924 and has since had a very distinguished career in developing the internal airways of India, and my friend Captain Taylor of the British Petroleum Company who through all these years has also maintained his interest in aviation. Then on the other side of this award there is mention of the subsequent Oxford University expeditions, which have been to all parts of the world. I am glad to think that that also is associated with the award today: thank you very much, Mr. President.

The PRESIDENT: The Council has awarded the *Victoria Medal* to Professor S. W. Wooldridge of King's College, University of London. Professor Wooldridge is an authority on the geology, geomorphology and historical geography of south-east England, as a result of long continued and intensive field work. He has also, ably and untiringly, advocated the full recognition of geography in school and university, and of the value of the trained geographer in national life. In these and other directions he has rendered notable services to geographical studies in this country, and it is fitting that he should receive the Victoria Medal, awarded for "scientific research in geography."

Professor S. W. WOOLDRIDGE, in the course of his reply, said: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—With several of my fellow recipients, this award to me was a pleasant surprise, and I think I may say that my first, and continuing, sentiment was that I was sobered to find the succession in which I stood. It appears to me, Sir, an appropriate occasion when one's work is commended to cast one's mind back to those to whom one owes one's original training and I accordingly recall, with respect and affection, particularly Dr. J. W. Evans, that veteran explorer-geologist, then at Birkbeck College; my old friend and later colleague, Dr. A. Kingsley Wells, of King's College, and one of my present colleagues Professor L. Dudley Stamp; I am glad to see one of my teachers actually here today. If all those were geologists, I would venture to say that they were none the worse for that and I am none the worse for that either. Meanwhile, Mr. President, I receive this Award with intense pleasure and real gratitude.

The PRESIDENT: The *Murchison Grant* has been awarded by the Council to Dr. G. C. L. Bertram, Fellow of St. John's College, Cambridge, and Director of the Scott Polar Research Institute from 1950 to 1957, for services to Polar research and exploration. Dr. Bertram is a biologist with experience in the Arctic and the Antarctic —he was a member of the British Graham Land Expedition—and is an authority on the technique of Polar travel. He has also advanced Polar research and exploration as a member of the Joint Committee of the Norwegian-British-Swedish Antarctic Expedition of 1949–52, and as Chairman of the British North Greenland Scientific Committee. Dr. Bertram is now in New Zealand as visiting Professor at Otago University, and I will ask his wife to accept this Award on his behalf.

Mrs. G. C. L. BERTRAM: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—I feel very proud to be here this afternoon to receive the Murchison Grant on behalf of my husband. I am filled with gratitude not only for the honour done to him by the Royal Geographical Society but also for my own good fortune in having a husband who is considered worthy of such an award. I wish that he could be here himself but as that cannot be he has asked me to read you this message:

"The Society's award to me of the Murchison Grant gives me great personal pleasure and I am only sorry that my present visit to New Zealand prevents me from saying 'Thank you' in person. But I should like to say, indeed I think it is altogether apparent, that in this case whatever merit is found in the chosen recipient is only a reflection of the equal zeal and energy of the people with whom he has been associated. So, in conveying thanks to the Royal Geographical Society, I pay tribute to the staff

of the Scott Polar Research Institute in Cambridge with whom I had the good fortune to be blessed during my Directorship there for seven years."

The PRESIDENT: The *Back Grant* is awarded to Dr. R. J. Harrison Church of the London School of Economics. Dr. Church has made a special study of the human and economic geography of West Africa where he has travelled extensively with the cooperation of the authorities, carrying out field work and acquainting himself with conditions in British, French and Spanish territories. The results of his work have been incorporated in a recently published book on West Africa, with the sub-title 'A study of the environment and man's use of it.' It is a great pleasure to hand this Award to Dr. Harrison Church.

Dr. R. J. HARRISON CHURCH: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—May I say how surprised and touched I was by the announcement of an award to me? May I also say how honoured I am to receive this award, established by Sir George Back, a distinguished Arctic explorer, but given to me for work in regions so very different from the Arctic? But perhaps Admiral Sir George Back would not have minded too much, because his name is commemorated in this hall very near to such distinguished African explorers as Lander, Clapperton, Park and others. I feel proud to have received an award from this Society which from its very earliest days has played such a notable part in the scientific work and exploration of Africa, as indeed the names round the walls of this room testify. May I take this very happy opportunity of expressing publicly my thanks to the Governments, the institutions and the many people who have given me such generous help in my travels? I would also like to express my very deep thanks to the staff of the Royal Geographical Society, particularly those of the Map Room and of the Library, who have given me unstinted help over many years. May I say to all of them, both past and present, and to the Council for this award, a very deep "Thank you"?

The PRESIDENT: Mr. K. V. Blaiklock, to whom the *Cuthbert Peek Grant* has been awarded, was for several years on the staff of the Falkland Islands Dependencies Survey, and has had wide experience of exploratory survey in the Antarctic. He is now a member of the Trans-Antarctic Expedition led by Dr. Fuchs, and was leader of the advance party which established the southern base at Shackleton and wintered there in 1955–6. He receives the Cuthbert Peek Grant for the qualities of outstanding leadership he displayed in exceptionally adverse conditions then encountered. As he is still in the Antarctic, I will ask his father to receive the Award on his son's behalf.

Mr. H. G. BLAIKLOCK: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—It is with a very real sense of pleasure and privilege that I accept this Award on behalf of my son, Kenneth, who is still in the Antarctic. You will appreciate that messages are very difficult to come by but I have received a cable from him and he has asked me to express to you all his very deep feeling of gratitude for this honour. He wishes also to associate with this expression of his thanks his personal appreciation of the outstanding and splendid support he received from the whole of the advance party. May I, Sir, convey this message of thanks with the greatest sincerity.

The PRESIDENT: The Council has awarded the *Gill Memorial* to the distinguished New Zealand historian, Dr. J. C. Beaglehole, of Victoria University College, Wellington, for his work on the achievements of Captain James Cook, R.N., and as editor of Cook's *Journals*. Dr. Beaglehole, who has given many years to the study of the circumnavigator's career, is the editor of the definitive edition of Cook's *Journals* which is now in course of publication by the Hakluyt Society. Two volumes have already appeared. Many present today will have enjoyed Dr. Beaglehole's masterly study of Cook which was published in the *Geographical Journal* for December 1956. In Dr. Beaglehole's absence, I will ask his son to receive the Award on his behalf.

Mr. T. BEAGLEHOLE: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—My father has asked me to read the following message:

"I am very sensible of the honour the Society has conferred on me, and I have

asked my son to acknowledge this on my behalf. I am very sensible of the fact, also, that a historian has been thought worthy of a geographical honour. I am not, I find, the first New Zealander to receive the Gill Memorial: the award was made in 1897 to a hard-bitten explorer of our west coast, Charles Douglas. Unlike that master of bush and mountains and rivers, I have explored only by proxy, and by sea, not by land. But I have been in the company of a very great man, who would certainly have scooped the pool of awards if the Royal Geographical Society had been in existence when he was; and if I could nourish any resentment against the Society, the revered patron of explorers everywhere, it would be for not being the patron of James Cook. The Society cannot claim that happiness. But it can claim to have done a good deal in aid and assistance to those who have followed Cook in at least one department of his activity, for he was not merely the matchless discoverer and re-discoverer of Pacific islands, not merely the heaven-sent navigator of tropical reefs and shallows; he was also the first of our Antarctic explorers, and the work of his marvellous second voyage was an essential preliminary to the work that is going on in the Antarctic continent today.

"It is pleasant to me to reflect that while I, a New Zealander, am concerned with the exploration and mapping, as it were, of Cook's own *Journals*, other citizens of my country, which Cook first placed securely on the map, are taking an active part in the investigation of the ice-bound wilderness that defeated even Cook. And it was with a doubly-compound satisfaction that I learnt, a few months ago, that one of the books Sir Edmund Hillary was taking south with him, for assimilation in whatever hours of leisure he may have, was the first volume of the Hakluyt Society's edition of Cook's *Journals*. There are complexities in editing these journals. It has been astonishing to me to find, though Cook never—as he himself said—had an opportunity of cultivating letters, how very many hundreds of thousands of words he actually wrote. Even as an editor one has to learn a certain art of navigation. My voyage, I must add, and the publication of its results, would have been impossible without a great deal of help—from the Government of New Zealand, from my college, from other generous bodies and individual people. To work for and with the Hakluyt Society has been an enormous pleasure; and may I say, speaking from so far away, that in this sphere at least, Commonwealth consultation and cooperation has been a quite shining success."

The PRESIDENT: The *Mrs. Patrick Ness Award* goes this year to Mr. J. P. Heaney, leader of the Gough Island Scientific Survey, 1956. This expedition, which was organized in the face of considerable difficulties by Mr. Heaney (including his own illness on the verge of departure) was a model of its kind, and an excellent example of team work by a number of scientists. It was the first to make continuous scientific observations of this remote island in the South Atlantic, and Heaney, a trained surveyor, assisted by Martin Holdgate, carried out the first detailed topographic survey of the island. Many of you will recall the excellent account of the expedition given in this hall by Heaney and Holdgate last October and the film and slides which accompanied it.

Mr. J. B. HEANEY: Mr. President, Your Excellency, My Lords, Ladies and Gentlemen,—I consider it a great honour indeed to be the recipient of this Award, and I like to think of it especially as a tribute to the team spirit of the whole expedition and also as a tribute to the work that was done on Gough Island. Before we went there very little was known about the island, and it might be said even now that we have only scratched the surface and exposed the enormous possibilities there are there for scientific research. In the Tristan da Cunha Group and on Gough Island in particular there is still a wonderful and unique opportunity for observing the natural distribution and evolution of plants and animals. A very strong case exists for the absolute conservation on Gough Island of wild life, and this is even stronger if some practical scientific use is made of its protection from human influences. We hope that a possible sequel to this expedition to Gough Island might be the setting up of a

permanent sub-Antarctic Research Station on Tristan da Cunha to investigate some of the interesting problems there; this might be done with international cooperation.

The PRESIDENT: His Excellency, the Italian Ambassador, Count Zoppi, has honoured us by attending this meeting in order to be present on the occasion of the bestowal of the Patron's Medal on his compatriot, Professor Ardito Desio.

The PRESIDENT then appointed Colonel Cecil Thrupp and Professor A. C. O'Dell to act as scrutineers of the ballot for Council and Officers for the ensuing year.

The HON. SECRETARY (Dr. Edward Hindle) announced that Sir Raymond Priestley was unavoidably unable to stand for election as President, and the Council had asked Sir James Marshall-Cornwall to accept nomination for a further year. This he had consented to do. Therefore his name had been substituted on the ballot paper for that of Sir Raymond Priestley, the latter taking the place of General Sir James Marshall-Cornwall as a nominee for Vice-President.

While the ballot was proceeding the President drew attention to the Annual Report as circulated and invited the Honorary Treasurer to comment on the financial statement, because that constituted the most important part of the Report and all the Council's labours depended on it.

The HON. TREASURER (Mr. Leonard Brooks), after commenting on the Report said: Costs are still rising and income does not keep pace with them. The Council and the Officers take a great deal of pains to watch both income and expenditure. At the same time, together with this, there is need for increased income and, as the President said, the Fellowship is the way to get it. Recently the proposals have fallen in number, and I urge you to propose for Fellowship those who are interested in our objects.

We had hoped to be helped by covenanting. If covenanting for subscriptions had been allowed our income would have increased by over £1000 this year, because at the beginning of the year there were well over 300 Fellows who had covenanted. We should also welcome gifts for the general purposes of the Society and for the special objects on the exploration side, or for anything you wish. During the past year we have received one or two splendid gifts. One lady in Kenya, Mrs. Florence Kerr Wilson, who has been a Fellow for thirty-six years, wrote to say that the Society must be passing through difficult times, and would the enclosed cheque for £1000 help? You will note how that has most definitely helped the finances! I ask you all to consider the possibility of helping the Society chiefly by introducing new Fellows and then, if it can be managed, by a gift, small or large, and also, if you happen to be making your will, then leave a legacy to the Society.

The PRESIDENT: I would like to close the proceedings by offering, in your name, a word of thanks to our Honorary Treasurer. Leonard Brooks has been a Fellow of this Society for forty-two years. For the last eleven years he has served continuously as either Honorary Secretary or Honorary Treasurer, and before that he was our Vice-President for seven years—from 1939 to 1946. He has rendered most valued service to the Society. I assure you that our funds would not look so healthy as they now do had it not been for his constant and devoted care and attention. I thank him again for all the trouble he has taken.

On the formal proposal of Professor L. Dudley Stamp, seconded by Professor East, the Annual Report with the Balance Sheet was unanimously adopted, and it was announced that the candidates proposed for the Council and as Officers for the ensuing year had been elected.

Lord NATHAN: Ladies and Gentlemen, before the proceedings conclude I feel the time has come when we should take an active part in proffering our thanks to the President and to the Executive Officers. The ballot has shown that we were all of one mind that Sir James Marshall-Cornwall should be President again and that those who stood by his side should continue to fill the offices they have held. One

word about the President in particular because in the ordinary way he would today have concluded a triumphant period of office, the period of three years for which he was elected. It must be a sacrifice on the part of Lady Marshall-Cornwall, who is so devoted to the Society, that she has consented to her husband accepting the Presidency for a fourth year. I feel you all agree with me that we owe thanks both to Sir James and to Lady Marshall-Cornwall, and we are full of expectation that his fourth year of office will give as much satisfaction to the Society and to the President as the past three years have done. We must all have been, perhaps not so much surprised, but rather filled with admiration, that during the past three years Sir James, no matter the subject with which he has been confronted, has found the appropriate words in which to enlighten and enliven the proceedings. He has been an altogether admirable President and I ask you to join in offering him our best thanks for what he has done in the past and our good wishes for the year to come.

The PRESIDENT: I thank Lord Nathan for the very kind words he has spoken and you, Ladies and Gentlemen, for the way in which you confirmed the proposition. Although I feel deeply honoured by being asked to continue beyond my constitutional term for another year, it is a matter of great regret to me that Sir Raymond Priestley, who had been proposed for election by the Council to take over the Presidency now, has been unavoidably prevented from doing so, and has had to withdraw at the last moment. Sir Raymond Priestley would have been the obvious and outstanding personality as the Society's President, especially during the next year or two when this great trans-Antarctic adventure is in progress. As you know, Sir Raymond Priestley recently accompanied His Royal Highness Prince Philip during his visit to the Antarctic bases, and travelling round the Polar seas in *Britannia*, so that there was his personal acquaintance with His Royal Highness, our most distinguished Honorary Member, and all Sir Raymond's knowledge of the Antarctic. He was with both Scott and Shackleton in the Antarctic and carries on a great Antarctic tradition. It is really a tragedy that he could not at this time take over the Presidency of the Society. I personally feel deeply sensible of the honour you have done me and will do my best in a humble way to try to carry on for another year. I hope at the end of that period Sir Raymond Priestley will be able to take over as your President.

THE ANNUAL DINNER

The Annual Dinner of the Society was held at the Hyde Park Hotel, Knightsbridge, on 11 June 1957. General Sir James Marshall-Cornwall (President of the Society) and Lady Marshall-Cornwall received the company of 254, which included among the guests of the Society H.R.H. The Prince Philip, Duke of Edinburgh, H.E. the Italian Ambassador (Count Zoppi), Sir Gavin de Beer, Professor Ardito Desio, Brigadier Sir John and Lady Hunt.

The Loyal Toasts were proposed by the President and duly honoured.

H.R.H. PRINCE PHILIP, DUKE OF EDINBURGH, in proposing the toast of "The Royal Geographical Society," said: Mr. President, Ladies and Gentlemen,—I would like, first, to thank you, Mr. President, very much indeed for a good dinner which I have greatly enjoyed. Secondly, I would like to congratulate the Society on its 127 years of useful and energetic life. And then I would like to congratulate the President on three years of useful and energetic life!

It would take me all night if I tried to congratulate the Society on everything achieved during those 127 years of existence or on the number of famous people the Society has helped and encouraged. In any case, if the Society does not know about its own achievements and about the people it helps, it is too late for me to start telling you. The main point is that the Society continues to help and to encourage those who go out and try to find out what the world looks like. In fact, the Trans-Antarctic Expedition is now in progress and the Society was one of the first to help that particular venture. I take a rather personal interest in another expedition which

also received help from the Society, the Gough Island Scientific Survey, and I am glad to see here John Heaney who commanded that expedition and I am delighted to know that he received an Award this afternoon. I cannot help thinking that you ought to have made that Award a little earlier, and then the peak on Gough Island might have been named Marshall-Cornwall instead of Edinburgh!

However much I try to picture this exploring business, the fact remains that the middle name of the Society reminds me inevitably of geography and therefore of maps. I used to believe, as do probably most of you, that what was on a map was true, but the recent journey on which I have been has convinced me that map-makers and geographers are considerable optimists. However, I do see that there is a problem facing both geographer and map-maker. After all, just because a man does not know for certain what he should put on the map he cannot just leave an area blank and say "I am sorry, I don't know what goes on here; the chap who told me about it is very unreliable, anyway." While that might be honest it might undermine the confidence of people. But the great thing about it is that there is a great deal of fun in proving that the map is wrong, even if that is only for one's own satisfaction.

The Society has in the years of its existence done a great deal towards the improvement of knowledge of the physical features of the earth. The difficulty now is that it is running out of explorable areas. However, probably enough remains for the present generation to explore. And you can always console yourselves with the thought that in the meantime some other planet may be available for exploration—always assuming that those there have not already produced their own maps!

While it is true that the scope for original explorers is narrow, nevertheless the scope is as big as ever for secondhand explorers. I personally always derive tremendous pleasure every time I see any part of the earth for the first time. I would like to see it all if I could. I have seen a certain amount of it, and that has kept me away from home quite a lot. Nevertheless, it gives me great pleasure to see new places. I only wish the weather would always be good so that every time I fly I can see the places below.

Whatever happens, the Society has done great things, and I believe it has a tremendous future, particularly if it continues its work with the traditional vigour and energy it has shown in the past. So, Mr. President, I give you the toast of "The Royal Geographical Society," coupled with your own name as its President.

The PRESIDENT, in responding, said: May it please Your Royal Highness,—On behalf of the Royal Geographical Society it is my privilege to express our deep appreciation of the many kind words which you have spoken about ourselves, our aims and our activities.

We are indeed delighted, as well as honoured, to welcome Your Royal Highness to our Dinner this evening; and to welcome you, not only as our most distinguished Honorary Member, and not only as the Consort of our beloved Patron, Her Majesty The Queen, but as a geographer in your own right and as one who, if I may say so, has better title to be called a geographer than most of us round these tables. For you are a past master of the "haven-finding art," as it was called by Edward Wright, the Elizabethan hydrographer, when referring to the art of navigation. You can steer your own ship and pilot your own aircraft; you have girdled the earth, and in particular the British Commonwealth, in order to study at first hand its human as well as its physical geography; you have even qualified as a teacher of geography; less than three months ago, when you gave that inspiring lantern-lecture in the Festival Hall to thousands of thrilled school-children, describing your recent Empire journey, it was well and truly said that "never had so many youngsters learned so much geography in so short a time."

More recently you have repeated that geography lesson to a still larger class by means of that modern educational medium known to the great majority of your pupils as "the Telly." With every justification, therefore, we welcome Your Royal Highness as "the Prince of Geographers."

Your Royal Highness has graciously referred to the fact that I have completed three years, the normal term, as President of the Royal Geographical Society. During that period the Society has continued to play its traditional part in the support and encouragement of exploration. The first ascent of Everest was made during my predecessor's term of office, but during my term of office the second two highest mountains in the world have been successfully climbed for the first time. This afternoon we recognized the great achievement of that intrepid, well-organized and brilliantly led Italian expedition which conquered K2 (Kappa Due) by awarding our Patron's Medal to the brilliant leader of the expedition, Professor Ardito Desio, who is with us this evening, just as last year we bestowed our Founder's Medal on Charles Evans, the leader of the Kangchenjunga expedition, that British expedition which successfully, and perhaps unexpectedly, climbed Kangchenjunga. As Your Royal Highness well knows, because you were Patron of the expedition, that expedition was sponsored, planned and organized by this Society in conjunction with our friends, the Alpine Club. During the last three years there has also been planned and launched that great Commonwealth enterprise, the Trans-Antarctic Expedition, in the support of which our Society has had no inconsiderable part.

The President of the Royal Geographical Society indeed inherits a weighty responsibility for upholding the great traditions of our past. One of the few constructive acts for which I can personally claim credit during my term of office is to have rescued from the limbo of an attic—some shrapnel-scarred and mouldering from war damage—the portraits of my forty predecessors in office and to have caused them to be reframed, relabelled, and hung in chronological array round the walls of the President's study. To live with these impressive portraits of past Presidents has been for me both an inspiring and a humbling experience. Great names such as Barrow, Murchison, Rawlinson, Markham, Curzon, Freshfield and Younghusband take some living up to. To record all their careers in full would be to epitomize British Empire history during the past seven reigns—more than a century and a quarter—for they were all men who had made their mark in various forms of public service. It is, in fact, symbolic of the many-sided nature of geography that our Presidents should represent such varied aspects of the national life.

I would like, Sir, just to give you a thumb-nail sketch of our first three Presidents because they have left behind them a great tradition. Our first President (1830–33) was Frederick Robinson, Viscount Goderich. Educated at Harrow and Cambridge, at the age of twenty-five Frederick Robinson was elected Member of Parliament for Ripon, as a moderate Tory. During the peace negotiations in Paris in 1814 he served on Lord Castlereagh's staff. He was Chancellor of the Exchequer for four years from 1823 to 1826. He was quite a good and far-seeing Chancellor of the Exchequer in spite of the somewhat disparaging nicknames given him by William Cobbett, such as "Prosperity Robinson" and "Goody Goderich." In his first year as Chancellor Frederick Robinson set aside £40,000 to build the present British Museum, and in his second Budget he put aside £60,000 to found the National Gallery. In 1827, on the death of Canning, he became Prime Minister as Viscount Goderich, but resigned a year later in favour of the Duke of Wellington. During his first three years as our President Lord Goderich had little leisure in which to attend to the Society's business because he was then Secretary of State for War and the Colonies. Matters improved slightly in his fourth year of office when he became Lord Privy Seal and was created Earl of Ripon.

Our second President (1833–35), General Sir George Murray, was a soldier and a Scotsman. The younger son of a Perthshire Baronet, George Murray in 1790 obtained his commission in the 3rd (now the Scots) Guards. He served under Sir Ralph Abercromby at the battle of Alexandria in 1801 and under Sir John Moore at Corunna in 1809—both tough and bloody battles, for on each occasion the British Commander-in-Chief was killed in action. During the greater part of the Peninsular War Colonel George Murray was Wellington's Quartermaster-General. In Wellington's

army the Q.M.G. was not just the chap who ordered up the rations and the rum. That was the job of the Commissary General—quite a different person. The Q.M.G. in Wellington's day was responsible for all field survey and reconnaissance and for issuing every movement and operation order. The Duke of Wellington did not hand out many bouquets to his staff officers and, in fact, he never had any use for any staff officer but George Murray. He was described by the Duke as "a very able man and an admirable Q.M.G." After the Peninsular War Sir George Murray served successively as Governor-General of Canada, Commander-in-Chief in Ireland and under the Duke of Wellington's administration in 1828 as Secretary of State for the Colonies. During his time as President of the Society Murray was also Master-General of the Ordnance.

Our third President (1835–37), Sir John Barrow, was a very different type, but still more remarkable than his two predecessors. A Lancashire lad of humble origin, John Barrow started to earn his living as a clerk and timekeeper in a Liverpool foundry; at the age of eighteen he went to sea as a deck hand in a Greenland trawler. Later he became an assistant mathematics teacher in a school in Greenwich. In 1792 he obtained a clerical appointment on the staff of Lord Macartney's diplomatic mission to Peking. Macartney was so impressed with Barrow's character and ability that he took him with him five years later to Cape Colony as his Secretary. Barrow there made ample use of the opportunities afforded him to explore unknown country. In 1804 John Barrow was appointed Permanent Secretary to the Admiralty and held that post for forty years, being created a Baronet in 1835, the year in which he became our President. John Barrow more than any other man was responsible for founding the Royal Geographical Society; he was also responsible for fostering our early interests in both African travel and Polar exploration. While at the Admiralty he was an unceasing advocate of naval expeditions to seek the North Pole and the North-west Passage.

Although drawing its inspiration from the past our Society, Sir, is more than ever prepared to face the problems presented by the future. Your Royal Highness's encouraging words will confirm us in our great purpose, which is enshrined in the three words of our Latin motto—chosen for us 121 years ago by our fourth President, William Hamilton, and inscribed on our Royal Medals—"OB TERRAS RECLUSAS"—"To reveal the World."

LORD RENNELL: May it please Your Royal Highness,—It falls to me as a very indifferent substitute for Sir Raymond Priestley to propose the toast of "The Medallists and Guests"—the Medallists of the Society this year and the Guests of the Society this evening.

In first taking up the theme of the President's remarks on the ubiquity of the interests of this Society, may I say that the first two Awards given by the Society before they were Medals were to Mr. Richard Lander for his discovery of the sources of the Niger, and the first circumnavigation of the Antarctic continent by John Biscoe. It is therefore fitting that this year the Society should give the Patron's and Founder's Medals to Professor Ardito Desio and Sir George Binney and the third, the Victoria Medal, to Professor Wooldridge.

I would like to speak, first, of Professor Ardito Desio; he has climbed K2, but that is only the last of fifteen major expeditions which Professor Desio has led. He is a worthy successor of the last Italian recipient of the Gold Medal of the Society, Professor Fillipo da Fillipi under whom Professor Desio served in one of his expeditions. Since then Professor Desio's career has been in the Himalaya, the Karakoram, Libya and the Sahara, and not only in leading expeditions but in unravelling the geography of all the areas in which he has travelled. He has not only been an intrepid explorer but also a scientist who has on every occasion and in every expedition in which he has taken part contributed much more than merely the fact of having been there; he has contributed to the knowledge of the world, which is the basis of the scientific activities of this Society. It is right and proper that his name should be

Ardito—the hardy one. He is of the tribe of people who see a range of mountains or a desert and then want to see what is on the other side. That is the clue, I suppose, for many explorers—if they will only look to see what is on the other side and bring back the knowledge.

We are very happy to have also as our guest the Italian Ambassador, representing a country with which many of us, and perhaps I in particular, have been associated, and to remember in his presence the geographical and scientific achievements of the predecessors of Professor Ardito Desio—the Duke of the Abruzzi, the Duke of Aosta, the Duke of Spoleto. I hope His Excellency, if so minded, will convey to the Italian Government the respect in which all those names are held, coupled with that of Professor Desio.

As to the second Medallist, Sir George Binney—apart from having been the protagonist of the Oxford University Exploration Club he was the first person in the Arctic to introduce the element of air exploration in very early days. Perhaps some of us think Sir George has waited too long to receive the Medal which he has been awarded today. But he was the protagonist of what has now come to be regarded as common form in geographical exploration, in other words air survey, and he has inspired all those who have succeeded him, in the Arctic and Antarctic, in finding out, mapping and wondering why. We also owe a very great debt of gratitude as a nation to Sir George Binney for what he did for us in the early days of the last war in the North Sea and the Skagerrak, and I doubt whether he will ever allow anybody to write the whole story of one of the most magnificent bits of buccaneering ever achieved, which was carried out under his command. Since then he has gone on serving his country as an administrator, and as a steel master.

The third Medallist, Professor Wooldridge, has probably done more since Sir Halford Mackinder to make geography a modern, scientific, live study in the academic places where it should be studied and he has inspired young people everywhere. Professor Wooldridge is a very worthy recipient of the Victoria Medal, which the Society gives for outstanding achievement in geographic science.

Your Royal Highness, of the guests it is much more difficult to speak because for many of us it is always a matter of opinion and not of fact about who is a guest and who is here as of right. Your Royal Highness, you are here as of right, but you are also our guest. Sir John Hunt is here as of right. I ask you, coupled with the names of the Medallists, to drink to our guests here and, if Your Royal Highness will permit me, you shall on this occasion be our guest.

Sir GEORGE BINNEY, in responding, said: Mr. President, May it please Your Royal Highness, Your Excellency, My Lords, Ladies and Gentlemen,—It is indeed a great honour to respond to this toast, but he would be a brave man who would not feel some diffidence in responding to the toast of " The Medallists."

Now, the Society—and this I know as a Vice-President of it—gives its Awards I would like to say justly because I am a recipient, but it certainly gives its Awards to those who teach geography and who administer geography and also to those, such as Professor Desio, who achieve geography. We have here two intrepid mountaineers who have succeeded in getting nearer to Heaven than anybody else can ever reach. I see also on the starboard side of this table my old friend, Sir James Wordie, with whom all my expeditions were discussed and who was both in the Antarctic with Shackleton and, for many years after the 1914–18 War, in the Arctic. I then see the proposer of our health, Lord Rennell, who moving from oasis to oasis in the southern Sahara persuaded the Senussi, I suppose, to reduce their overdraft.

Among the Awards you have one for the increase of geography as a study; you have the award of history in the contribution to the life of Captain Cook; and you have the award given for economic geography in the increase of our knowledge of African geographic economy. No Award has pleased me more than that given to my old friend Dr. Bertram, the head of the Scott Polar Research Institute, a very timely award considering the great use which is made throughout the world of the unique

service which the Scott Polar Research Institute offers. In the Awards for exploration one is delighted to see the Cuthbert Peek Grant going to Mr. Kenneth Blaiklock, leader of the advanced party somewhere in the Antarctic. Then the Award which particularly appeals to me as a reader of the *Geographical Journal* is that given to Mr. John Heaney for his expedition to Gough Island. When one was young in the days just after the 1914–18 War, a man got up in the morning and said to his friends: "Let's go continent hunting," and a man who had not discovered an island was considered a fellow of very little importance. John Heaney is one of those who gets together with others at his University and says: "Let's look on some maps and see what there is to do. Where can we go? What can we do?" I have great faith that Mr. Heaney possesses this true Elizabethan spirit. The Gough Island Expedition demonstrated the way in which the Society is able to assist really worthwhile expeditions. As the President has told us, funds are not available to the extent which anybody interested in geography would like them to be, but the Society does provide instruments which would be far beyond the purchasing power of many expeditions. It provides modest support and, even more important, the Society never interferes in the plans of the expeditions. Once the Society has approved the idea and decided to support an expedition, then whoever is concerned in organizing it is told to go ahead, and return and tell the Society what has been achieved. I had all that support from the Society in the days long ago—in 1921, 1923, 1924. We had the loan of instruments and we had the prestige of the backing of the Society; we were told to go out and do what we could. Exploration has gifts of enormous value to those who undertake it, who meet the challenge of conditions, who practice self-discipline in all their ordeals, and learn to evaluate the risks they are going to take. How vital it is to all of us, whether we be at a University, whether we be in one of the Services or the professions, that there should be people with those gifts derived from exploration, people able to undertake whatever work they put their hands to, knowing that they will have to take risks and that they will have to evaluate them; people always able to look over their shoulders and say to themselves: "Well, in such a situation I find my way out by doing this." We are most fortunate in having the inspiration of His Royal Highness towards the development of youth along the lines of exploration.

Another point is, that individuals, whatever their willingness and generosity, are no longer able to finance exploration. So it really belongs now to industry and commerce to provide finance for exploration by youth when they have the mind to go out. Personally, I am very optimistic. I think we can do very much more than has been done in the past to provide the money.

Finally, on behalf of my co-Medallists and in his honour I would like just to repeat certain words used by Prince Philip: "Though he be sure that he will never hit the mark, yet as high as he is he will shoot higher and aim fair and good." In the case of Professor Desio as indeed in the case of Sir John Hunt, they were able to aim and they were able to achieve.

Sir Gavin de Beer replied on behalf of the guests.